The FOUNDRY

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Eyes of Foundry Industry Turn to Chicago

CHICAGO will welcome visitors to the American Foundrymen's association convention, June 6 to 10, with whole hearted hospitality. Leaders of the industry in the world's largest foundry center have labored diligently to prepare plant visitation

and entertainment programs that long will be remembered by those fortunate in attending. The editorial pages of the special Chicago section contained in this issue of THE FOUNDRY trace the underlying causes for the remarkable growth in the number of foundries in Chicago and present the results of a survey of the foundry industry recently conducted by THE FOUNDRY in that midwest metropolis. Hearty tribute also is paid to the men and women of Chicago who serve as hosts on this occasion. The advertising pages of the special Chicago section portray the ingenuity, foresight and ability of manufacturers of equipment who made possible the wonderful progress recorded in Chicago's foundry industry.

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Midwestern City

WELCOMES

FOUR times in the period of its thirty-one years' existence the American Foundrymen's association has designated Chicago as the scene of its conventions. The first was in 1900, when the organization was swinging into the stride that has made it one of the greatest technical organizations of the century. Then, as in 1927 the month of June was the time and in fact the same week of the month was chosen for the three days sessions that were held at the Great Northern hotel. W. A. Jones, who headed the foundry that still bears his name, was chairman of the entertainment committee and many familiar names, now found in the large group of Chicago manufacturers and foundrymen who will offer the city's hospitality, in 1927, appeared in the list of hosts for 1900 and the later Chicago conventions in 1913 and 1914. Prominent among these is S. T. Johnston, now vice president of the American Foundrymen's association.

In 1900, J. S. Seaman, familiar to thousands of warm friends as Daddy Seaman, was president, John A. Penton was secretary, and at the election held on the closing day of the convention, W. A. Jones was elected to serve the next year as head of the American Foundrymen's association. A small exhibition was held in the ball room of the hotel.

The conventions of 1913 and 1914 held on succeeding years, possess many points of similarity. In each case the headquarters were located in the LaSalle hotel and the exhibition, conducted by an independent company, occupied the International amphitheater, located at Forty-second and Halsted streets. In each case the convention was held in the fall, the exhibition opening on the Saturday preceding the convention and continuing for the following week, excepting Sunday. In each intance, also, the American Institute of Metals, as the society then was known and the Foundry Foremen's as-

For the Fourth Time

FOUNDRYMEN

sociation held joint and simultaneous sessions.

During the 1913 Chicago convention, H. D. Miles was president and Alfred E. Howell was president elect. The latter who now is general manager, Somerville Stove Works, Somerville, N. J., held over to the second convention, when R. A. Bull, now director of the Electric Steel Founders' Research group was elected.

Passing years between the 1914 convention and the present have developed many interesting contrasts. Thirteen years ago a total of 170 foundries were listed in the city. Contrast this with the more than 200 shops now operating in the city, many of which are listed in detail in the special section accompanying this issue. At that time the total membership of the American Foundrymen's association was given as 970. When the 1927 convention opens at the Edgewater Beach hotel on Monday June 6, representatives of a total membership of over 2200 will be in attendance. Complaint was registered at the 1914 meeting that the program, which included a total of more than 40 papers on the American Foundrymen's association sessions and many more for the other groups named, was too long and that sufficient opportunity was not allowed for discussion and for the development of wider opinions. This feature apparently has been taken into consideration in the program prepared for the meeting this year.

Unusual opportunity is offered by the arrangement and classification of subjects in the 1927 program for full and complete disscussion and the interchange of ideas. The brevity of the program and the marked importance of the papers offered guarantee wide discussion and assure the contribution of many valuable pointers on modern foundry practice. A feature of outstanding interest, where the discussion is the vital influence in clearing up questions of importance to the industry, is the

(Concluded on Page 379)

Tentative Program of Events

Headquarters, Edgewater Beach Hotel

June 6 to 10, 1927

MONDAY, JUNE 6

10:00 a. m. to 5:00 p. m.—Registration.

Plant Visitation.

Committee Meetings.

6:30 p. m.—*Conference of Instructors of Foundry Practice.*

TUESDAY, JUNE 7

8:00 a. m.—Breakfast Gatherings—Promoting Acquaintanceship.

9:30 a. m.—General Opening Meeting.

10:30 a. m.—*Apprentice Training.*

Chairman: H. A. FROMMELT, Davenport, Ia.

Upgrading Foundry Apprentices, C. Howard Ross, general manager, Union Malleable Iron Co., East Moline, Ill.

Training Apprentices, A. W. Gregg, Bucyrus Company, South Milwaukee, Wis.

Discussion of Training Problems.

10:30 a. m.—*General Foundry Practice.*

Chairman: J. W. BOLTON, The Lunkenheimer Co., Cincinnati.

Specifications for Miscellaneous Foundry Materials, V. A. Crosby, metallurgist, Studebaker Corp., South Bend, Ind.

Application of Metallurgical Principles to Foundry Practice, J. H. Andrews, Royal Technical College, Glasgow, Scotland. Exchange Paper of Institute of British Foundrymen.

Plumbago Blackings as Applied to Foundry Work, D. G. Anderson and A. N. Ogden, Western Electric Co., Chicago.

2:00 p. m.—*Foundry Costs.*

Chairman: A. E. HAGEBOECK, Frank Foundries Corp., Moline, Ill.

2:00 p. m.—*Conference on Qualities of Pig Iron for Casting Purposes.*

Chairman: R. H. SWEETSER, American Rolling Mill Co., Columbus, O.

Discussion Leaders: R. S. MacPherran, Allis-Chalmers Mfg. Co., Milwaukee; Dr. R. Moldenke, Watchung, N. J.; David McLain, Milwaukee; J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala.; J. W. Bolton, The Lunkenheimer Co., Cincinnati; E. J. Lowry, Hickman-Williams Co., Chicago.

Evening—**General Entertainment Feature.**

WEDNESDAY, JUNE 8

8:00 a. m.—Breakfast Gatherings. Promoting Acquaintanceship.

10:00 a. m.—*Foundry Sand Control.*

Chairman: BENJAMIN D. FULLER, Cleveland.

Some Practical Results of Sand Control, M. Kuniansky, Lynchburg Foundry Co., Lynchburg, Va.

Report of Committee on Grading Foundry Sand, Chairman, A. A. Grubb, Ohio Brass Co., Mansfield, O.

Report of Committee on Testing Foundry Sands, Chairman, H. Ries, Cornell university, Ithaca, N. Y.

Effect of Moisture Absorption on the Properties of Cores, H. L. Campbell, University of Michigan, Ann Arbor, Mich.

12:15 p. m.—*Round Table Conference on Nonferrous Foundry Problems.*

Chairman: N. K. B. PATCH, Lumen Bearing Co., Buffalo.

The round table conference will follow a luncheon gathering of those interested in brass founding.

1:30 p. m.—*Cast Iron Metallurgy.*

Chairman: R. F. HARRINGTON, Hunt-Spiller Mfg. Corp., Boston.

The Coulibility Bar, C. Curry, Ardennes, France. Exchange Paper of the French Foundry Technical association.

Some Graphite Formations in Cast Iron, J. W. Bolton, The Lunkenheimer Co., Cincinnati.

Fatigue of Cast Iron, H. F. Moore and S. W. Lyon, University of Illinois, Urbana, Ill.

Effect of Nickel and Chromium in Cast Iron, R. S. Poister, Electro-Metallurgical Sales Corp., New York.

1:30 p. m.—*Malleable Foundry Sand Control.*

Chairman: L. C. WILSON, The Federal Malleable Co., Milwaukee.

Discussion Leaders: H. B. Hanley, Whitehead Bros. Co., Rochester, N. Y.; H. W. Dietert, The United States Radiator Co., Detroit.

Synthetic Sands in the Malleable Foundry, F. C. Scheiber, General Electric Co., Erie, Pa.

1:30 p. m.—*Steel Founding.*

Chairman: R. A. BULL, Electric Steel Founders' Research Group, Chicago.

A Development in Ovens for Mold Drying, J. M. Sampson and G. H. Wright, General Electric Co., Schenectady, N. Y.

Characteristics of Some Steel Molding and Core Materials, E. R. Young, Detroit Steel Casting Co., Detroit.

Report of A. F. A. Committee on Steel Casting, Chairman, A. R. Jameson, Deemer Steel Castings Co., New Castle, Del.

Report of A. F. A. representative on Committee on Investigation of Effect of Sulphur and Phosphorus in Steel, R. A. Bull, Chicago.

Report of Committee on Heat Treatment of Ferrous Metals, Chairman, A. H. Lorenz, Bucyrus Corp., Milwaukee.

4:00 p. m.—Business Meeting.

6:30 p. m.—**Banquet.**

THURSDAY, JUNE 9

8:00 a. m.—Breakfast Gatherings. Promoting Acquaintanceship.

10:00 a. m.—*Gray Iron Shop Problems.*

Chairman: L. L. ANTHES, Anthes Foundry Co., Toronto, Canada.

Analysis of Four Hundred Tons of Defective Castings, J. M. Haley, Crompton and Knowles Loom Works, Worcester, Mass.

Study of Chapleting, M. Varlet, Sclession, Belgium. Exchange Paper of Beligan Foundry Technical Association.

Temperature Measurements of Cupola Iron, H. W. Dietert, United States Radiator Co., Detroit.

10:00 a. m.—*Nonferrous Founding.*

Chairman: N. K. B. PATCH, Lumen Bearing Co., Buffalo.

Reduction of Molding Losses, R. A. Greene, Ohio Brass Co., Mansfield, O.

Aluminum Bronze Castings, W. M. Corse, Aluminum Bronze Manufacturers' institute, Washington.

Gating Brass Castings—a Conference on Various Methods of Gating Brass Castings.

10:00 a. m.—*Malleable Foundry Problems*

Chairman: L. C. WILSON, Federal Malleable Co., Milwaukee.

Variations in Pig Iron Qualities, R. S. McCaffery, University of Wisconsin, Madison, Wis.

2:00 p. m.—**Boat Trip, Compliments Chicago Committee.**

FRIDAY, JUNE 10

All Day—**Plant Visitation.**

(*Concluded from Page* 379)

conference on the qualities of pig iron for casting purposes, scheduled for Tuesday afternoon, June 7. R. H. Sweetser, American Rolling Mill Co., Columbus, O. plant, who presided at a similar conference held by the American Institute of Mining and Metallurgical Engineers last February, will occupy the chair.

Visual education is productive of results. This is an axiom of teachers and has been proved during the past winter by a series of practical sand test methods before groups of various local foundry organization members. Following this line of thought, the American Foundrymen's association papers committee has arranged for the demonstration of equipment in common use to determine permeability, strength, fineness and moisture content at the session on foundry sand control scheduled for Wednesday, June 8, at 10 a. m.

The interest of all foundrymen in sand, further is shown by the special session arranged for 1:30 p. m. on Wednesday, when, under the leadership of H. B. Hanley, Whitehead Bros. Co., Rochester, N. Y. and H. W. Dietert, United States Radiator Corp., Detroit, the subject of sand for malleable foundry use will be explored.

A special round table session has been called for Wednesday noon, under chairmanship of N. K. B. Patch, Lumen Bearing Co., Buffalo, where the brass foundry operators will have a chance to participate in the discussion of problems peculiar to their branch of the foundry industry.

Maj. R. A. Bull will preside at the session on steel founding scheduled for Wednesday afternoon. A number of exceedingly important reports on various committee activities of the American Foundrymen's association and affiliated technical organizations will be presented. These will be supplemented by a brief program of papers by authorities in this branch of the industry. The application of fatigue testing to cast steel will be presented by Prof. H. F. Moore, University of Illinois, Urbana, Ill., president elect of the American Society for Testing Materials and chairman of the National Research council committee on fatigue testing.

Methods of teaching and training workmen in the industry has attracted increasing attention during the past few years. The work of the association in fostering this necessary line of endeavor will be recognized by a general meeting on apprentice training, called for Tuesday morning and further by a dinner and conference of instructors on foundry practice scheduled for Monday evening, June 6. The instructors conference will consider the questions of co-operation between the technical schools and industry, fundamentals of a course of instruction for technical schools and the proper layout and equipment for such schools. Opportunity will be offered the foundry teachers in attendance to visit the leading foundries and manual training schools of Chicago and vicinity.

Undoubtedly one of the outstanding attractions of the forthcoming convention to foundry men will be found in the opportunity to visit and inspect many of the leading foundries of the country. The variety of products made in Chicago foundries probably is not excelled in any city in the world. Standing pre-eminent in certain lines of manufacture, the city has kept in the vanguard of progress in foundry lines. Therefore the educational opportunities of plant visitation have been recognized by the association. Two entire days are set aside for organized plant inspection trips and in addition, a number of the leading foundries have thrown open their doors to the visitors during the convention week. A feature of special interest has been provided for Friday, when places in the Ottawa and Joliet districts, a national center of production for silica sand, molding sand and special clay, will be thrown open to the visitors. Full details of the plant visitation schedule and a list of the foundries of Chicago and vicinity with detailed data on the class of work performed, will be found on pages 30, 31 and 32 of the special Chicago section which accompanies this issue of THE FOUNDRY.

The social features which make the annual American Foundrymen's association conventions such pleasure filled occasions, have been given much thought in the arrangements for the Chicago gathering. Breakfast parties to promote acquaintanceship and fellowship have been planned for Tuesday, Wednesday and Thursday mornings. Opportunity will be afforded foundrymen to meet and know men of outstanding attainments in the definite lines in which they are interested, through grouping and some sort of recognition emblem designating the class of activity. A special entertainment has been arranged by the Chicago committee for Tuesday evening, and the banquet will follow on Wednesday. A boat trip is planned to occupy Thursday afternoon. Special entertainment plans are being made for the ladies as guests of the Chicago committee during the week.

Testing Society To Meet in French Lick, Ind.

The thirtieth annual meeting of the American Society for Testing Materials will be held at the French Lick Springs hotel, French Lick, Ind., from June 20 to 24. June 20 has been reserved for committee meetings and registration. On June 21 at 2 p. m. the general opening session will be held, followed by two simultaneous technical sessions. The Edgar Marzurg lecture will be delivered on the afternoon of June 22. In all, 13 sessions will be held during the 5-day meeting which is the first annual meeting that the organization ever has held in the Middle West.

Engineers Hold Meeting

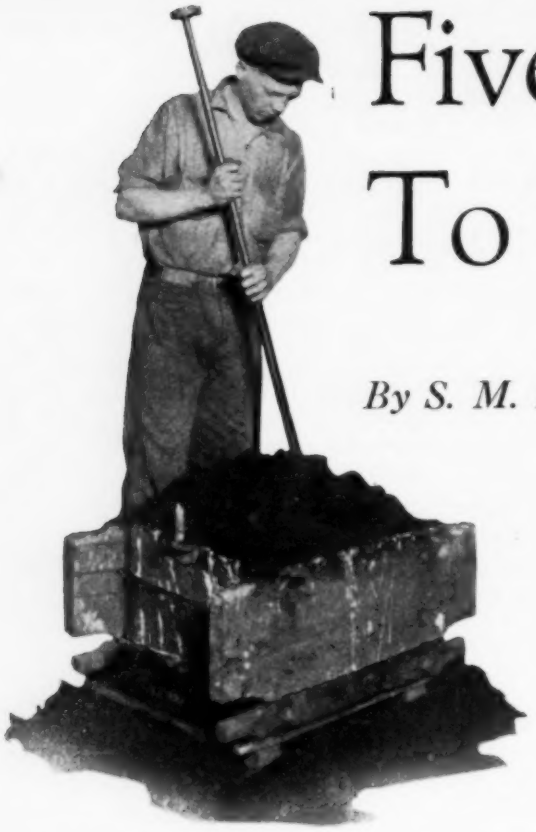
The first aeronautic meeting of the American Society of Mechanical Engineers was held at the Hotel Statler, Buffalo, on April 30. V. E. Clark, Consolidated Aircraft Corp., Bishop Clements, Curtiss Aeroplane & Motor Corp., William P. McCracken, Jr., assistant secretary of commerce in charge of civil aviation; and Elmer A. Sperry, Sperry Gyroscope Co., addressed the meeting. According to the speakers, the trend of airplane manufacture is toward all metal type ships. Inspection of the Buffalo airport and Buffalo airplane factories occupied a large part of the convention schedule.

Held Heating Course

The General Electric Co., Schenectady, N. Y., held its sixth annual industrial heating course from April 18 to 30. Forty representatives from various central stations throughout the United States attended the course. The course was given under the auspices of the National Electric Light association to acquaint central stations with the possibilities of industrial heating loads, the field of application and equipment available. Meetings were held at the Schenectady N. Y., and Pittsfield, Mass., plants of the company.

Sponsor Research Work

The University of Michigan, Ann Arbor, Mich., has received an appropriation of $10,000 from the American Gas association for a program of intensive research in the use of gas for steel treating. According to Prof. A. E. White, head of the department of engineering research of the university, a specialist in metallurgy and a staff of laboratory assistants immediately will start a series of investigations on this problem to determine the technique of operation.



Five Industrial Cities To Train *Apprentices*

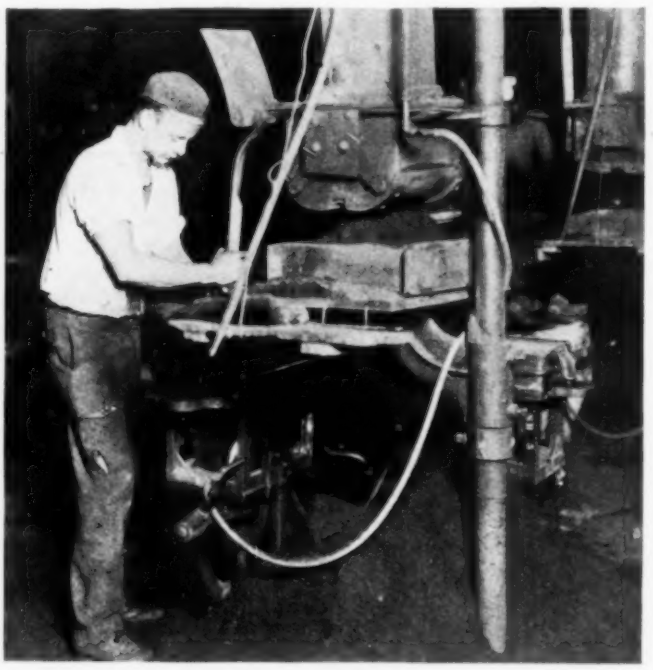
By S. M. Brah

APPRENTICESHIP is no exception to the saying that there is nothing new under the sun and that history repeats itself. However, it is natural that since vast strides have been made in science and education, apprenticeship, which depends upon both, also should take a step forward in methods and standards of training. Today a program has been evolved which is so flexible that it may be adapted to fit practically any condition. Interesting work in apprentice training now is being carried on in five communities, which are located in two states but are so grouped as to form the logical training unit.

For the benefit of those unfamiliar with the geography of the community, these cities of the Mississippi valley will be described. The two states, Illinois and Iowa are divided naturally by the Mississippi river which runs east and west through the section in which the cities are located. East Moline, a thriving industrial city of 10,000 inhabitants is located in Illinois. Adjacent on the west is Moline, the parent city by name, known far and wide as the home of agricultural implements since the day John Deere, the father of the steel plow, started to build that vast organization which still holds his name. Adjoining Moline is Rock Island, a city of 30,000 inhabitants, industrial in its general makeup and an important cog in the wheel of this industrial circle. Davenport, Iowa, the largest of the cities is located directly across the river. Seventy-thousand people reside in this busy little city at the gateway to the west. Bettendorf, a small town, is located east of Davenport and is the home of the Bettendorf Co. and the Zimmerman Steel Co., large producers of railroad castings and railroad cars.

Farm implements and accessories predominate in the list of articles manufactured in the district. Other industries located there manufacture laundry equipment, gas engines, electrical household appliances, harness, hardware, automobiles, railroad cars, science apparatus, elevators, jobbing castings, industrial locomotives, and pumps. A variety of establishments participate in this apprenticeship program, uniting not only industry, but the schools and practically all of the inhabitants.

A summary at this point of the industrial situation in this center may give a better understanding of the many problems arising in connection with apprentice training. Five relatively small cities, located in two states have a total of 41 companies which vary in size from five employes in the smallest to 1200 in the largest and envelop seven trades in varied types of shops with different degrees of skill required by nearly each concern. Upon reading this summary any one aspiring to start a community apprentice-



Boys Working in the Plant Were Given First Chance to Enroll

Combine Forces

ship program probably will feel that his problem is small compared with the task of organizing an apprenticeship training program in the district which has been described.

Such was the picture which greeted those who were about to undertake the job of molding this mass into a working model apprenticeship program. Some time ago the Tri-City Manufacturers' association was ready to act provided that someone could be found to launch and pilot this relatively unstable craft until it rode safely on the smooth waters. Consequently a contract was entered into between the association and the apprentice training department of the International Correspondence schools, Scranton, Pa., and personnel was placed in the field to undertake this task.

For years the subject of apprentice training had received much consideration and thought by individuals and committees of the Manufacturers' association. Four years ago the local foundrymen organized the Quad-City Foundrymen's association. The moving spirits of the foundry industry used this association to further plans for a comprehensive program of apprenticeship. It was not until a proposal was presented to this association which provided for adequate personnel to accomplish the task that a definite step forward was taken. The Quad-City Foundrymen's association then merged its identity, as regards apprenticeship activities with the Tri-City Manufacturers' association a beginning was made.

Joseph Hecht Heads Foundry Training

All Features of the Program Were Explained to the Applicant

The formal agreement with the International Correspondence schools was signed April 7, 1926. Immediately two members and later a third from the apprentice training department set to work. A community survey was started, the local schools were approached and the necessary administrative committees representing the manufacturers were organized.

A committee was formed of the members of the association. This committee is known as the apprenticeship committee and its duties consisted in establishing policies and sponsoring the success of the program. Subcommittees were appointed to deal with problems in foundry, machine shop and woodworking shops. An educational committee was formed to deal with problems of study, schedule, facilities and policies of school work. A uniform indenture shown in the accompanying illustrations was drawn up and adopted by the general committee.

The separate committees next passed on the wage scales for the various trades and the special conditions arising in connection with wages. Provisions were made for accepting grade school graduates, high school and college graduates and adult specials. All were given consideration as to the wage allowance. Ideal work schedules covering the different trades and showing the number of hours to be spent on the different

operations also were drawn up and passed upon by these committees.

Semimonthly meetings were held by the committees until conditions justified meetings at longer intervals. Monthly meetings now are held to survey the progress of the program, to arrange for contests and to pass upon school policies and changes in work or rate schedules, which may be necessary from time to time.

With policies adopted and passed by the apprenticeship committee, the next step was to survey the plants and see where apprentices could be used to advantage. The survey also established the number required to overcome the turnover from death, promotions and losses by other causes. Negotiations were begun with each plant separately and the management consulted as to the present apprenticeship program in operation. If none existed the management's views on the matter were solicited and noted. Permission was obtained to proceed with the preliminaries and a mass of information was secured from the plant.

This information included the number of men working, the number of mechanics, the vital operations and their type, the average turnovers in special departments and special operations in the production of that particular plant. This information was noted and tabulated on a survey sheet prepared for this purpose. The information then was analyzed and a report prepared which stated the present program, if any, and the proposed program with a schedule of work for each trade to fit the needs of the particular plant. Wherever necessary, a detailed proposal was submitted for the proper administration of the entire program and the sanction and adoption of the management solicited.

The employing plant then appointed an individual whose duties are those of an apprentice supervisor and who has direct charge of the program and its results in his particular plant. The duties of apprentice supervisor may be briefly stated as follows:

Obtain a sufficient number of applicants to fill the requirements at all times.

Employ the apprentices as called for by the schedule or operating conditions.

TRI-CITY MANUFACTURERS ASSOCIATION
APPRENTICE INDENTURE

THIS INDENTURE, made in triplicate this .....day of .....,19....

between .....of ..... (City, State), hereinafter known as the Employer, and

.....of ..... (Address) ..... (City, State), a minor born

....., hereinafter known as the Apprentice, and .....,

hereinafter known as the Guardian, whose relation to the Apprentice is .....

WITNESSETH, That for the purpose of acquiring the Art or Trade of .....,

said .....hereby becomes an Apprentice to said Employer and said Employer hereby accepts him subject to the terms of this agreement and the regulations on the reverse side hereof.

The Employer Agrees:

1. The Employer agrees that he will cause to be carefully and skillfully taught to the Apprentice this trade to which he is hereby indentured, subject to the conditions of his shop.

2. The Employer shall have the right to terminate this agreement for inability on the part of the Apprentice to do the work or acquire the knowledge necessary for graduation, or for repeated infraction of the rules and regulations governing apprentices.

3. The Apprentice and his Guardian shall have the right to terminate this agreement for satisfactory personal reasons and upon proof of same, the Employer shall furnish a statement terminating the agreement.

The Employee Agrees:

1. The Apprentice and his Guardian hereby promise that the Apprentice shall conform to and abide by all provisions of this agreement, and shall faithfully and diligently serve his Employer during the full period of time named in this agreement.

2. The Apprentice and his Guardian agree that the Apprentice is to attend related class-room instruction..... hours per week or its equivalent. The cost of related school work, including textbooks, will be.....dollars. Of this amount, the Apprentice and his Guardian hereby agree that the Apprentice shall pay one-half, or.....dollars, at the rate of.....dollars per month, deductible from the pay of the Apprentice. The Employer hereby agrees to pay one-half of total cost, or.....dollars.

The Apprenticeship shall begin on the .....day of.....19....., and shall be for a period of.....years. The length of year, the compensation for the term of apprenticeship, and the processes, methods or plans to be taught shall be as per Exhibit A attached hereto.

At the completion of the apprenticeship, the Apprentice shall receive from the Employer a certificate stating that the work herein described has been satisfactorily performed.

IN WITNESS WHEREOF, the parties have caused this indenture to be signed:

.....Company

.....Employer .....Apprentice

By..... .....Guardian

A Uniform Indenture Was Drawn Up By the Local Committee

If Given Proper Attention and Help, the Apprentice Soon Develops an Interest in the Work He Is Doing

EXHIBIT A

Extent of Period of Apprenticeship:

This apprenticeship shall be for.....periods of.....hours each, or a total of .....hours, or.....years.

Schedule of Processes to be Worked—(Here must be stated the processes, methods or plans to be taught and the approximate time to be spent on each.)

The time distribution of the work schedules may vary from the above, which will be adjusted by the shop Superintendent dependent upon business conditions and the ability and the requirements of the apprentice.

Compensation to Be Paid—The Apprentice shall receive in wages:

.....cents per hour for the first period of 1220 hours.
.....cents per hour for the second period of 1220 hours.
.....cents per hour for the third period of 1220 hours.
.....cents per hour for the fourth period of 1220 hours.
.....cents per hour for the fifth period of 1220 hours.
.....cents per hour for the sixth period of 1220 hours.
.....cents per hour for the seventh period of 1220 hours.
.....cents per hour for the eighth period of 1220 hours.

Special Provisions:

Period of Apprenticeship and Compensation Were Noted

Provide for transfer of apprentices at the proper time to the various machines and processes, as demanded by their indentures.

Hold weekly meetings of the apprentices and arrange to have talks on shop and educational subjects.

Act as a representative of the management before apprentices in all matters pertaining to their training program and also to their welfare.

Enroll apprentices in the proper classes and supply them with suitable educational service and equipment. Recommend outside reading for the boys on current technical subjects in the various trade magazines.

Plan outside activities for the boys.

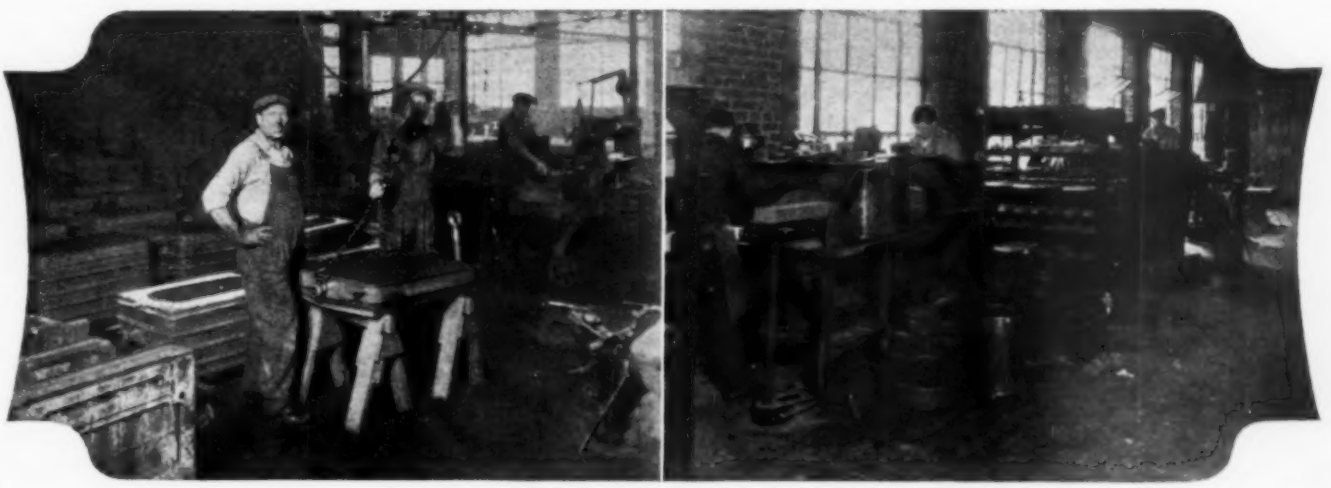
Act as guardian for the boy as long as he is an apprentice to that company. Molding the character of the boy as well as directing his training to journeymanship.

Select Boys Carefully

In recruiting apprentices, the boys then employed in the shop were interviewed first. Boys whose fathers had been in the employ of the plant for sometime were given second consideration providing their qualifications were satisfactory. This means of obtaining apprentices assured, to a certain degree, the type of boy desired. His integrity, sincerity and the home support which is so important in the success of keeping boys interested in this kind of program also were assured.

To interest other boys in the apprenticeship project, provisions are made whereby the boy at work during the day can get information at an appointed time during his leisure hours. Boys already enrolled bring their companions who are interested to the district office on designated evenings. Several hundred applicants have been interviewed and classified as to age, education, qualifications, the trade desired. The applicant then is given a rating based on these considerations.

It may be interesting to give an account of one of the typical interviews we have with the boys. Upon questioning him it is discovered that the average boy is loath to follow the trade of his father. His own first choice will run to radio or to some



Practically Every Phase of Foundry Operation Is Covered in that Part of the Course Relating to Shop Practice

technical field in which it might be difficult for him to find steady employment in the locality. After a complete explanation of the possibilities and the opportunities which a trade such as the foundry holds for him, he begins to see the light. He becomes more interested, but is not entirely sold on the idea until it has been explained definitely just what will be expected of him and the future that is in store for him. This situation is as it should be for who contracts to buy anything or render any service without inquiring into all the conditions involved? So with the present day boy. The questions asked frequently would do credit to a much more mature mind.

While this may seem an elaboration of a district program, it must be remembered that some one must sell the young men of the community on the opportunity offered by industry. Through the advertising columns of the local papers he is sold the opportunities in sales work; his teachers have sold him on higher education, and so it remains for industry and those connected with it to sell the boy on the fine art of hard work and the opportunities that go with it.

The young man is told that he is expected to be trained as a mechanic and that his prospects of going ahead depend entirely upon his own application and mental capacity. He is told that he is to attend school one-half day a week and that a certain quality and quantity of school work is expected of him in return for the opportunity. With all this implanted in his mind, usually he is ready and eager to start his apprenticeship in the trade of his choice. The standard community rates and the schedules for the different trades are shown to the boy.

The schedule of work for a four-year course in a gray iron foundry is as follows:

Schedule of Work

	Hours	Months
Helping molding	600	3
Machine molding	1200	6
Bench molding	1200	6
Large core making	800	4
Small core making	900	4
Miscellaneous floor work	1500	8
Furnace or cupola	600	3
Green sand molding	700	3
Dry sand molding	700	3
Casting, checking—Sand Mixing—shifting—crane-work Shipping room—shake out— Laboratory	1250	5
Mill room and inspection	750	3
	9500	4 Years

Schedule of Rate

1st 6 months 25 cents.
2nd 6 months 30 cents.
3rd 6 months 35 cents.
4th 6 months 38 cents.
5th 6 months 41 cents.
6th 6 months 44 cents.
7th 6 months 47 cents.
8th 6 months 50 cents.

The day arrives when the apprentice starts his probation period at the plant. He is watched carefully for the first few days. The experience is new to him and if the shop is unaccustomed to having apprentices around, there is a tendency to ride the newcomer and see how much horseplay he will stand. This cannot be done with the type of boy the management hopes to get under the new order of things. He must be given encouragement, told that the gas will not kill him, that the heat is not as bad as he imagines it to be, that it is not a case of sand shoveling all his life and the mill-room is not the only place in which he will work. He is taught to look beneath the sand pile and through the bags for the myriads of interesting things which may be discovered in the modern foundry. A little of this encouragement will keep the mortality down and after the first few weeks the boy's enthusiasm grows, for there is much to learn and master.

Schools Lend a Hand

Further consideration of the first steps of organization is interesting. Hand in hand with gaining the co-operation of the mangement of the plants came the essential matter of gaining the wholehearted co-operation of the school board since the school problem plays an important role in an undertaking of this kind. The boards of education in each city and the superintendents were interviewed and their co-operation solicited for the success of this community venture. Five boards passed favorably upon the general idea and then asked for details. First the problem of finances arose. This was met by appealing to the state for aid in this project from state educational funds. It must be said the respective state officers of Illinois and Iowa were quick to see the worth of the experiment and their aid was assured from the start. With this promise the school boards were approached again and their approval given.

It seemed unwise to go ahead on too big a scale at the start so it was decided to join the three municipalties into one on the Illinois side of the river and employ one instructor, a specalist, to cope with the education of the apprentices. The final result was that East Moline, Moline and Rock Island joined hands in sharing 50 per cent of the salary of the instructor, the state sharing the other 50 per cent. Iowa has approximately the same arrangement, the local school board providing the instructor and paying one-half of his salary, the remainder being paid by the state.

The classroom work is carried on in the regular school buildings centrally located and the instructor goes to each town to meet with the apprentices, his students. This makes a minimum amount of traveling. The classes are of a four hour duration and cause little interruption to the shop production schedules. This class work consists of mathematics, civics, shop economics, English and related work. In regard to the related work we will cite for an example the related work included in the foundry course in addition to those subjects previously mentioned.

Related work in a foundry course of study is as follows:

Green sand molding—4 parts
Core making
Machine molding
Dry sand and loam work
Foundry appliances—2 parts
Hardening and tempering
Heat treatment of low carbon steel
Foundry chemistry—2 parts
Mechanical principles—2 parts
Cupola practice
Mixing cast iron
Malleable castings—3 parts
General appliances and processes

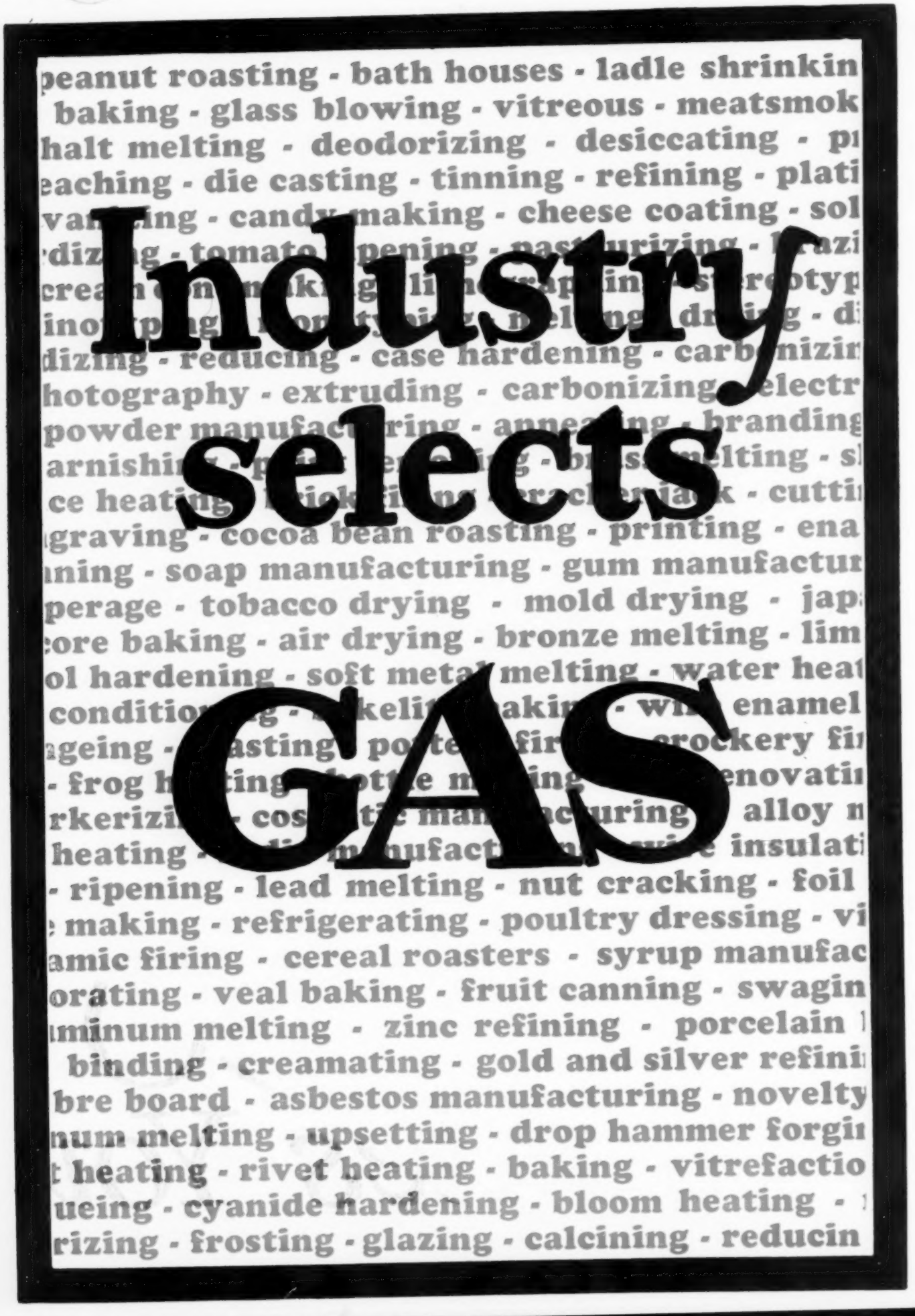
Such a course gives the boy an understanding of the technical side of his trade while learning the practical side working in the shop. Questions arise day after day which he cannot have answered by those around him, either because of the inadequacy of their knowledge or due to lack of time on the part of his foreman or fellow workers. These questions he soon learns to solve largely for himself as his technical training progresses.

Publicity Helps Cause

As in all undertakings, publicity has helped to produce results. The fact that such a program exists in the community is brought before the eyes of the people from time to time through the newspapers and other means. Talks are given before civic organizations, parent-teachers' meetings, and other bodies to recall to the minds of the citizens that opportunities exist in the shops and offices of their community industries. They are shown that the home town has tremendous advantages and opportunities for them, which are available to all with the proper qualifications and disposition. The graduating classes of the various schools are addressed on the opportunities in industry and the graduates are invited to visit the shops. Thus new recruits of high intelligence are found who have had the best of training. It is the understanding that the cream of manhood is wanted, upsetting somewhat the idea that when

(*Concluded on Page* 390)

CHICAGO
Invites You


peanut roasting - bath houses - ladle shrinkin
baking - glass blowing - vitreous - meatsmok
halt melting - deodorizing - desiccating - pi
eaching - die casting - tinning - refining - plati
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orating - veal baking - fruit canning - swagin
minum melting - zinc refining - porcelain
binding - creamating - gold and silver refini
bre board - asbestos manufacturing - novelty
num melting - upsetting - drop hammer forgi
t heating - rivet heating - baking - vitrefactio
ueing - cyanide hardening - bloom heating -
rizing - frosting - glazing - calcining - reducin

Industry selects GAS

60,000 USES *for* GAS

In the FOUNDRY

core baking
mould drying
ladle heating
water heating
skin drying
space heating

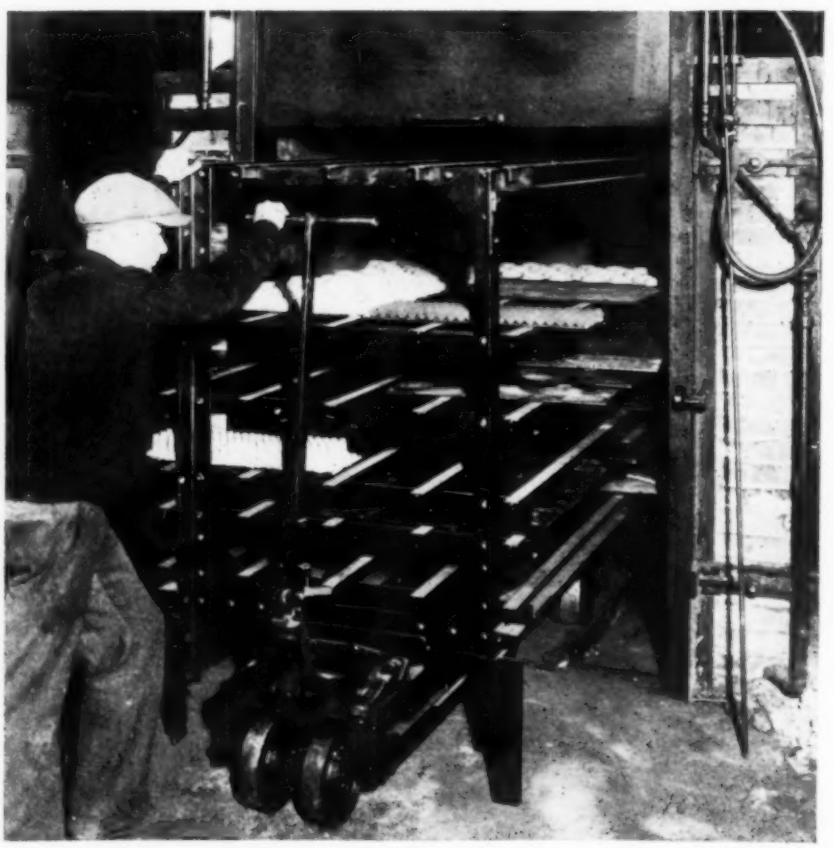
IF IT'S DONE WITH HEAT

When you visit Chicago's Foundries *look for the*

Gas-fired Equipment

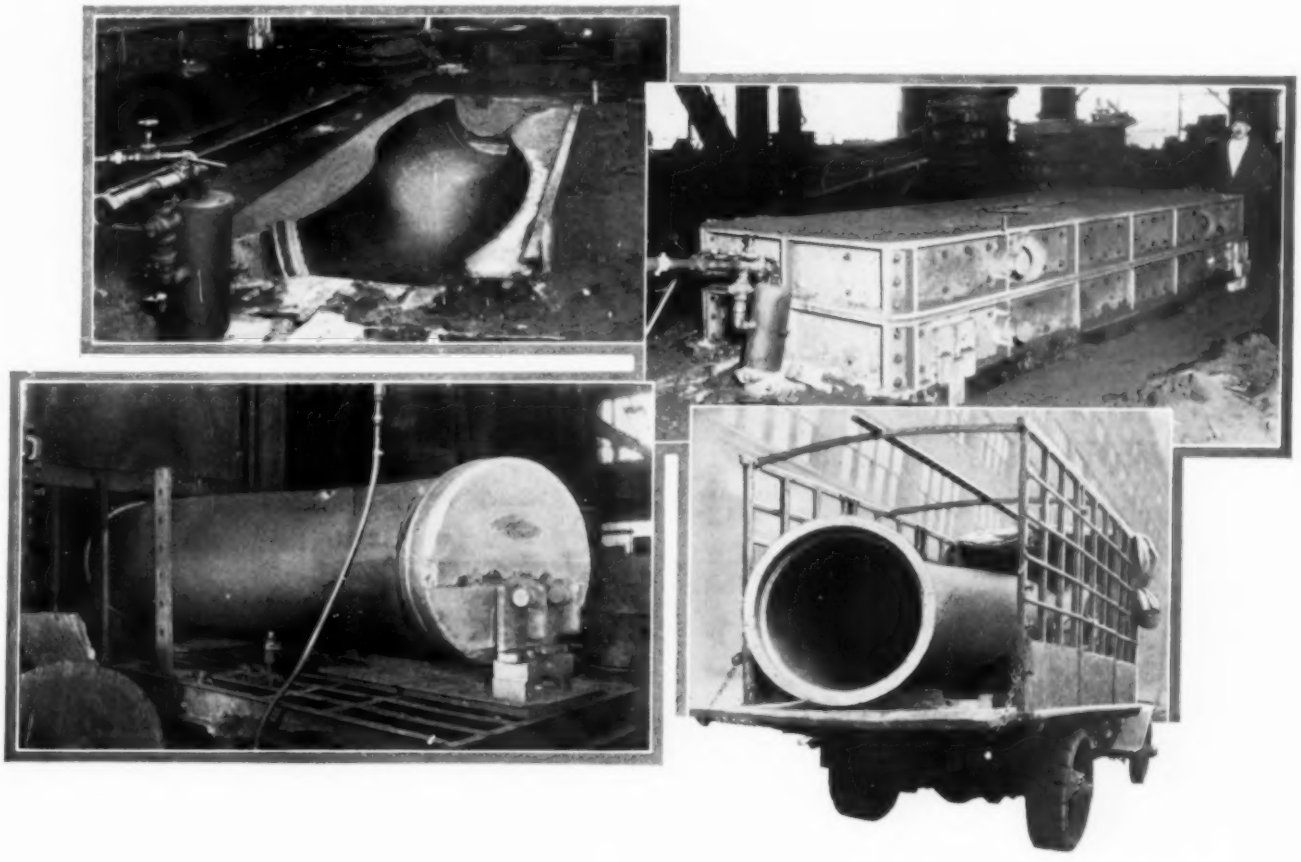
The Foundries listed below use gas for different operations

Ace Foundry Company
Burnside Steel Foundry Co.
Jas. B. Clow & Sons Co.
Cribben & Sexton
Ferguson & Lange Fdry. Co.
Grabler Mfg. Company
Hansell-Elcock Company
Kling Bros. Engineering Works
Magnus Metal Company
Nugent Steel Castings Co.
O'Malley Beare Valve Co.
PettiboneMullikenCompany
Western Foundry Company



The Peoples Gas Light *and* Coke *Company*

YOU CAN DO IT BETTER WITH GAS



The perfect casting of a curved cast-iron pipe fitting, four feet in diameter was accomplished with gas-fired equipment. The gas-fired mould dryer was used in perfecting this complicated 48-inch pipe fitting. The mould dryer is portable, and can be set in operation the moment the moulder finishes his work on the moulding floor. In this particular instance, the pattern was laid in the sand, one half at a time, and moulds made of it. Then the two moulds—top and bottom—were placed together. After the pattern had been removed, and before the molten iron could be poured, the sand had to be dried. The foundrymen met this great difficulty with the application of the gas-fired mould dryer.

This dryer made it possible to hold the enormous mould in position, and dry it satisfactorily. The casting was a perfect one the first time. Gas proved to be the best foundry fuel. It turns out a superior product.

When in Chicago visit our new exhibit of industrial gas equipment at 45-59 E. Pershing Rd. (39th St.) Many interesting types of industrial gas furnaces are on view in this display. Our Sales Engineers are in charge and will be very glad to give any information desired. Display room is open from 8:30 A.M. to 5:00 P. M.

122 South Michigan Avenue, CHICAGO

Half a Million Dollars

stands between you and the hazard of Experiment

THE American Gas Association has set aside the sum of $500,000 for laboratory testing and development of Factory Furnaces using gas for a fuel.

Manufacturers are not asked to put their money in any gas-burning equipment on an experimental basis. Careful, competent and scientific investigation will be made on any industrial gas-burning equipment the installation of which is under consideration by any manufacturer.

Write to the American Gas Association or your local gas company for facts, laboratory test and record of performance. They will gladly supply you with all available data.

Gas is the Ideal Factory Fuel—clean, convenient, economical and easily controlled. Get the facts.

American Gas Association
420 Lexington Avenue, New York City

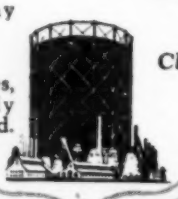
Send today for our interesting book,
"Gas — the Ideal Factory Fuel"

YOU CAN DO IT BETTER WITH GAS

Four Advantages of Gas

Dependable— any time, any place, any quantity.

Controllable— exact temperatures, automatically controlled.



Economical— lowest final cost per unit of production.

Clean— comfortable factory working conditions.

The American Gas Association

What it is—What it is doing for American Industry—

The object of the American Gas Association is to promote more and better ways of utilizing gas;

—to assist the industries of America (and the public as a whole) in deriving to the fullest the numerous advantages inherent in gas;

—to advance to the highest efficiency, methods of gas manufacture, distribution and utilization;

—to collect and disseminate information on these subjects.

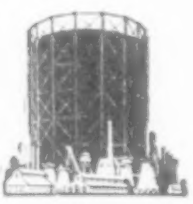
The American Gas Association was organized in 1918—and consolidated with the American Gas Institute, and the National Commercial Gas Association.

The membership includes 551 Gas Companies, 21 Holding Companies, 428 Manufacturers of gas burning appliances, and 3,444 Individual memberships. Its activities and interests extend to every state in the Union.

The sales of gas for the year 1926, officially reported to the American Gas Association, amounted to 38 billion cubic feet more than the amount sold in 1925. This is twice the increase in 1925 over 1924—making a total increase of 40% in the last five years.

This phenomenal increase in the use of gas is largely due to the growing demands from industrial customers. The American Gas Association has recently appropriated half a million dollars for research work and development of the industrial gas heating business.

Write to the American Gas Association for information on what gas is doing for others in your line of business.

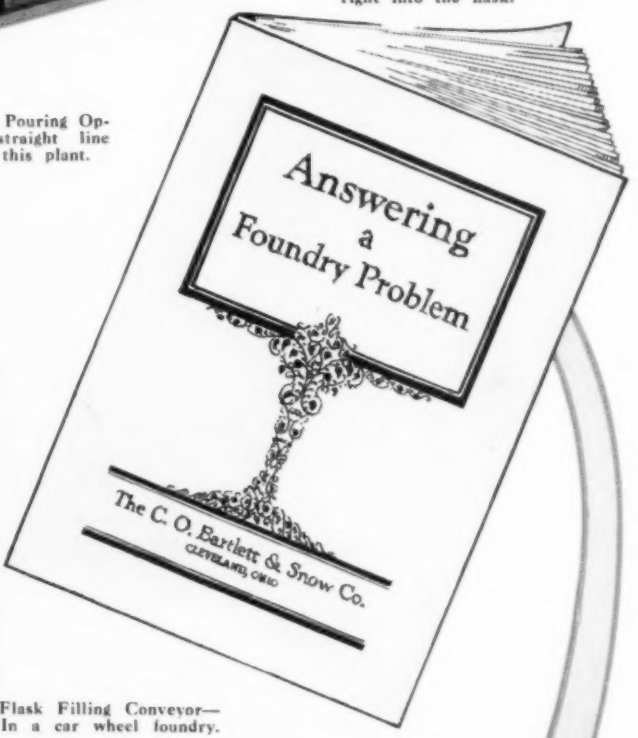


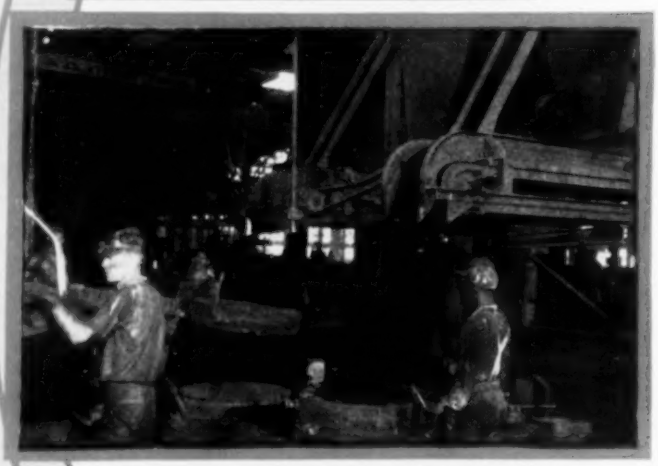
American Gas Association
420 Lexington Avenue, New York City

YOU CAN DO IT BETTER WITH GAS

Molding Operation—A pull of the lever drops sand out of the overhead hopper right into the flask.

Molding and Pouring Operation—A straight line operation in this plant.





Flask Filling Conveyor—In a car wheel foundry.

Central Sand Storage Bin—Where tempered sand is thoroughly seasoned.

Reciprocating conveyor for returning knockout sand to conditioner.

Pouring Malleable Iron Continuously
with Bartlett-Snow Equipment

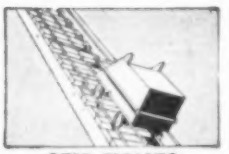
To Produce Castings That Cost Less

If you are thinking about ways that you can cut your foundry costs in 1927 we have a suggestion to make.

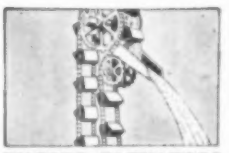
Let a Bartlett-Snow Engineer show you exactly how other foundrymen have cut costs as much as 50%, and increased production and profits accordingly. This will not cost you one cent or put you under the slightest obligation.

The booklet, pictured on the opposite page, shows many 1926 installations in leading grey iron, malleable, steel, brass and aluminum foundries. It's free. Let us send you a copy.

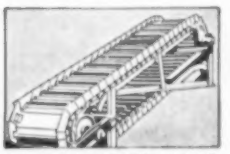
THE C. O. BARTLETT & SNOW CO.
6201 Harvard Ave. Cleveland, Ohio



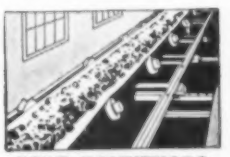
SKIP HOISTS



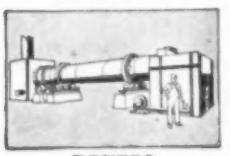
BUCKET ELEVATORS



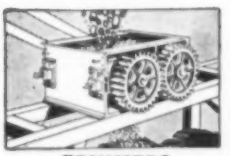
APRON CONVEYORS



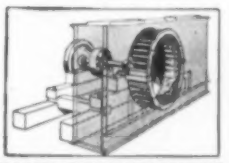
BELT CONVEYORS



DRYERS



CRUSHERS



SAND CONDITIONERS

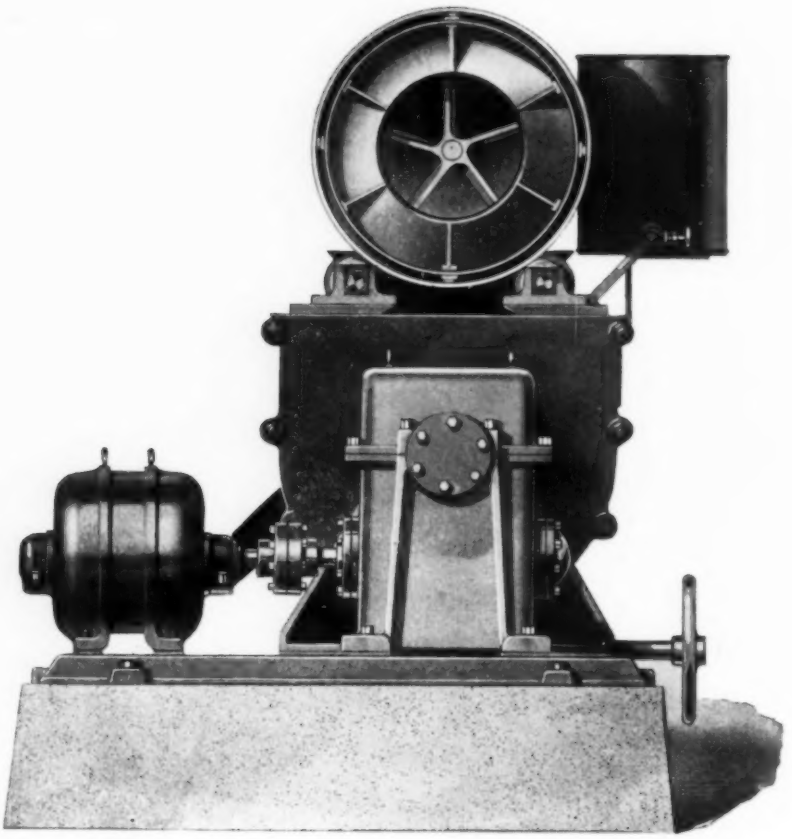
Bartlett-Snow

SAND HANDLING EQUIPMENT

Mr. FOUNDRYMAN

A New High Speed Production

The Finest Piece of Equipment Ever Offered to the Foundry



END VIEW

Built to meet the production demands of tomorrow! Built to keep pace with an output your foundry has never yet been called upon to deliver! Built to make such output possible!

One Hundred Pounds to One Ton per minute
Core or Facing Sand—*perfectly* mixed!

For over twenty-six years "STANDARD" Sand Handling Machinery has been building an enviable record for itself wherever sand machinery is used—a record for performance, for endurance, for lower maintenance cost!

And all the experience, all the knowledge, all the ability of our staff as a result of those years, have gone into the development and production of a Sand Mixing Machine which will banish forever those troubles "you used to have".

We have produced such a machine—Here 'Tis! Mr. Foundryman—

We offer it to you. Three sizes, capacity 3 to 60 tons per hour, perfectly mixed.

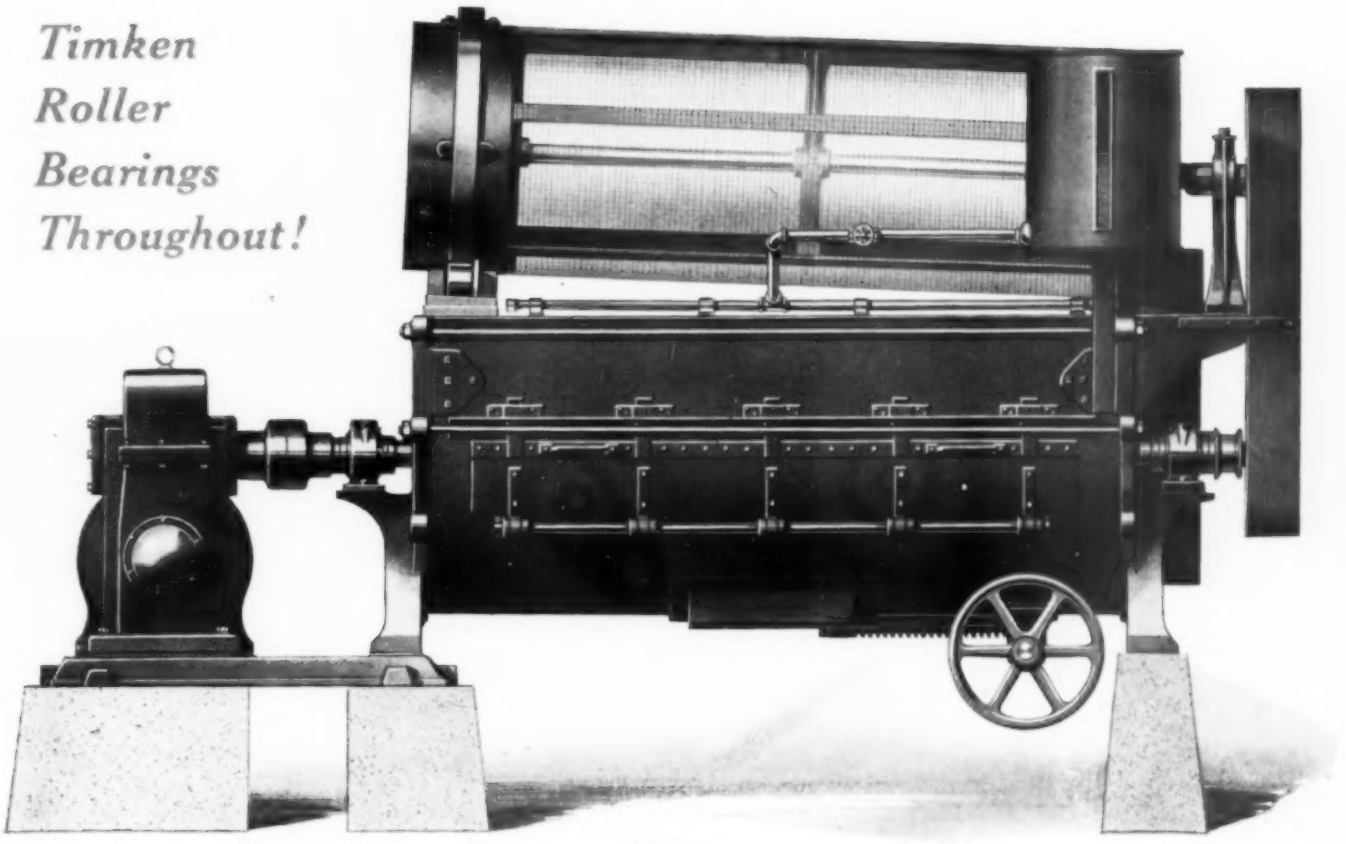
The Standard Sand

5151 St. Clair Ave. N.E.

HERE 'TIS!

Core and Facing Sand Mixer

Timken Roller Bearings Throughout!



SIDE VIEW

Constantly working the sand *toward* the center, the 36 mixing paddles are so constructed as to give the mixture a "surf" or "undulating" motion and a shaft speed of 30 r.p.m. actuates 1080 paddle strokes during that time, insuring a perfectly blended mixture.

The paddle tips, screen trunnions, tire and sprocket wheels, all of which are points subjected to unusual abrasive action, are made from "Meehanite" one of the toughest metals known (600 Brinell and from 45,000 to 60,000 Tensile). The inside of the mixing trough itself, a point of tremendous wear, has a ¾" lining of this same tough metal. The speed reducer is of the worm and gear type and the very highest quality obtainable. If conditions demand a Spur Gear Reducer, we are prepared to furnish it. All gears are enclosed and protected from damaging abrasive action.

This machine is so full of years of service we feel free to let you write your own guarantee ticket.

& Machine Company

CLEVELAND, OHIO

The Leading Brass Foundries Of

CHICAGO

Melt Their Metal In

DETROIT
ELECTRIC FURNACES

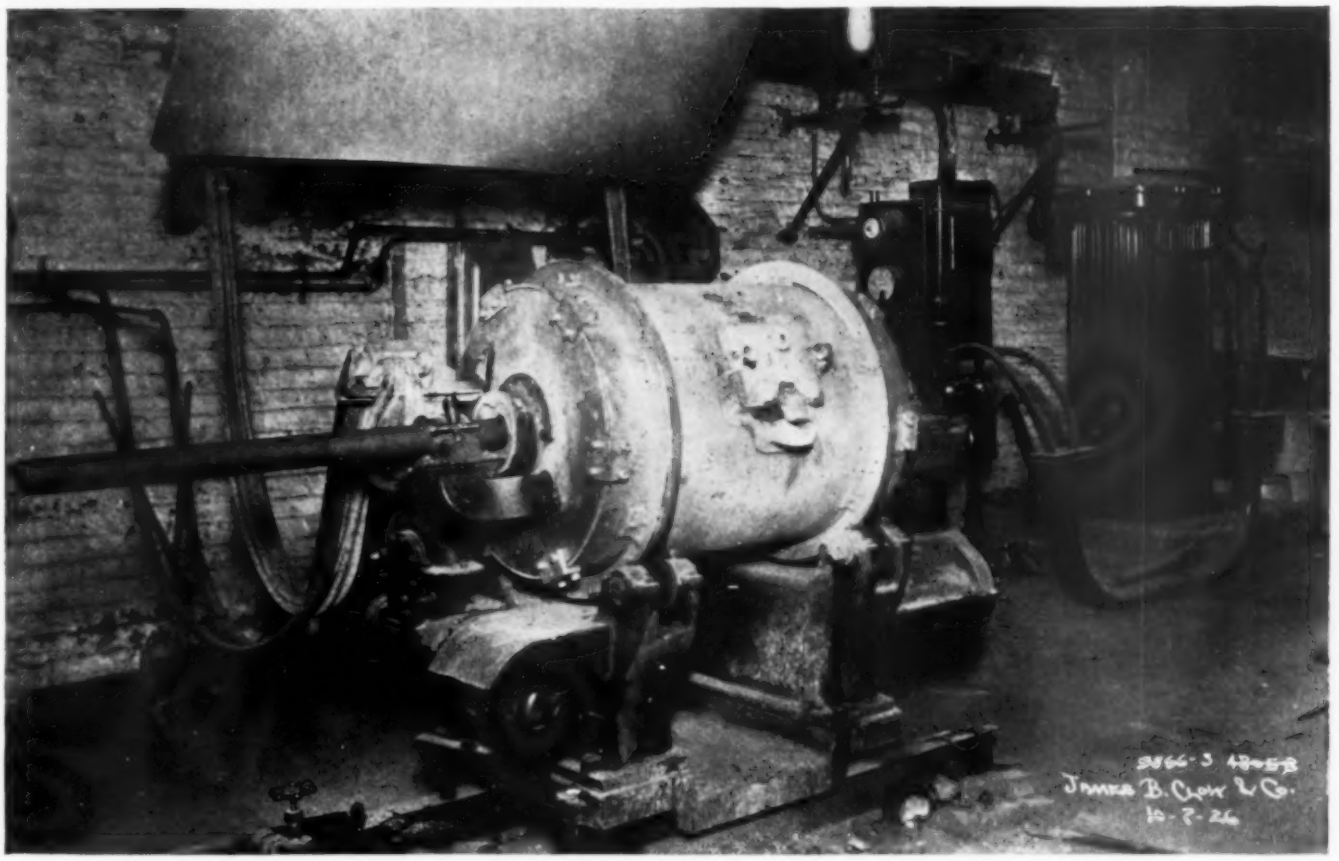
Visit the Detroit Furnace Installations while at the Foundrymen's Convention in Chicago, June 6-10 and Learn First Hand How

DETROIT ELECTRIC FURNACES

Insure Brass Melting Success By Producing

BETTER CASTINGS CHEAPER

The Modern Melting Machine



Type L.F.A. 350 lb. Detroit Furnace Installed in plant of Jas. B. Clow and Sons, Chicago, Ill.

Detroit Electric Furnaces are in use in the following Brass Foundries in Chicago

Crane Co.
Jas. B. Clow and Sons.
Superheater Co.
Goodman Mfg. Co.
Wolff Mfg. Corp.
Thompson-Neaylon Mfg. Co.

Ask The Man Who Uses One.

Detroit Electric Furnace Co.

825 West Elizabeth St., Detroit
419 Call Bldg., San Francisco

Sure! We'll Be At The Convention!

Come to Chicago

EVERYTHING YOU NEED IN YOUR FOUNDRY.

31st. Annual Convention A.F.A.

June 6-10

Edgewater Beach Hotel

ESTABLISHED 1874

Chicago.
The home of Obermayer.
Center of the foundry industry.
You will find a warm welcome here.
A good program has been prepared for you.
Representative foundries will be open to visitors.
See these Chicago plants and study their methods.
Of the 38 plants to be visited, each is an Obermayer customer. You will see many examples of quality work done with Obermayer supplies. You could see the same thing in the big foundries of any big industrial center.
When you want such quality for your foundry you can depend on getting it from Obermayer. The House that for 53 years has been furnishing quality equipment and supplies to foundries all over the world.
You don't have to be in or near Chicago to get the Obermayer quality and service.
There is an Obermayer warehouse near you.

THE S. OBERMAYER CO.

2563 W. 18th Street, Chicago, Ill.

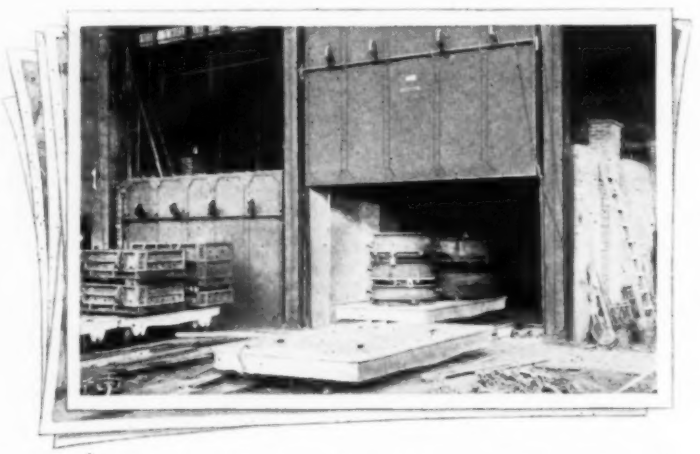
Warehouses: Chicago, St. Louis, Newark, N. J., Milwaukee, Minneapolis, Detroit, Denver, Seattle, Chattanooga, Cincinnati, Pittsburgh, Birmingham

A Few of the Leading Obermayer Lines:

Baskets, Bellows, Blacking, Brooms, Brushes, Chaplets, Carborundum, Firesand, Cements, Fire Resisting, Clamping Machines, Charcoal, Clamps, Core Compounds, Core Oils, "Peerless", Core Ovens, Core Trays, Cranes, Crucible Furnaces, Crucibles, Cupolas, Cupola Linings, Electric Vibrators, Fire Brick, Flasks, Flour, Grinders, Hoists, Jackets, Ladles, Lycopodium, Molding Sand, Molasses, Pails, Parting Compounds, Plumbago, Riddles, Rosin Mills, Sand Mixers, Sand Pins, Skim Gates, Sea Coal Facing, Sprayers, Sprinkling Cans, Tools, Squeezer Machines, Trucks, Tumbling Mills, Vent Wire, Wheel Barrows

F5-15-Russell T. Gray, Inc.

In the Chicago District



Battery of Coleman Car Type Mold Ovens. Similar battery now being built for Bucyrus Co., South Milwaukee, Wis.

COLEMAN
CORE & MOLD OVENS

REPRESENTATIVE foundries in the Chicago District as in every other section of the country are enthusiastic in their praise of Coleman oven performance and appreciative of the valuable service rendered by our engineering department in the selection and construction of suitable installations.

The exclusive patented features of Coleman Core and Mold Ovens appeal to the progressive foundryman who is interested in dependable oven operation, with lowest possible fuel cost and maintenance expense.

Coleman ovens are built in various types to suit all foundry conditions and for use with any fuel.

PORTABLE RACK OVENS — CAR TYPE OVENS
ROLLING DRAWER OVENS — SHELF OVENS

Write for complete Coleman Oven Catalog F

Some Users in the Chicago District:

International Harvester Co.
Bucyrus Co.
Chicago Hardware Foundry Co.
James B. Clow & Sons
Northwestern Fdry. Co.
Western Fdry. Co.
Wolff Mfg. Co.
Motor Castings Co.
Superheater Co.
Hammond Brass Works
Pullman Car & Mfg. Co.
Allis Chalmers Mfg. Co.
Crucible Steel Castings Co.
Falk Corp.
Harnischfeger Corp.
Southside Malleable Castings Co.
Lakeside Malleable Castings Co.
Belle City Malleable Iron Co.
Standard Fdry. Co.
Stowell Co.

The FOUNDRY EQUIPMENT Co.

Builders of Foundry Ovens & Furnaces
Contracting Engineers *and* Manufacturers
CLEVELAND, OHIO

A Truly Complete Line of Moulding Equipment

OSBORN'S exhibit for the 1927 A. F. A. Convention will be found on the following pages, and in the operating units at many of the Chicago Foundries listed for plant visitation.

Your particular attention is directed to the completeness of the Osborn Line. There is Osborn Moulding Equipment for all kinds and sizes of copes and drags—for jobbing foundries—for production foundries—and for the most modern and efficient continuous foundries.

Osborn Engineers will gladly work with you in solving your moulding problems, if you will give us the opportunity.

THE OSBORN MANUFACTURING COMPANY
INCORPORATED
5401 Hamilton Avenue Cleveland, Ohio, U. S. A.

Foreign Representatives

ALLIED MACHINERY CO.
Paris, France
Zurich, Switzerland
Barcelona, Spain

HORNE COMPANY, LTD.
Osaka, Japan

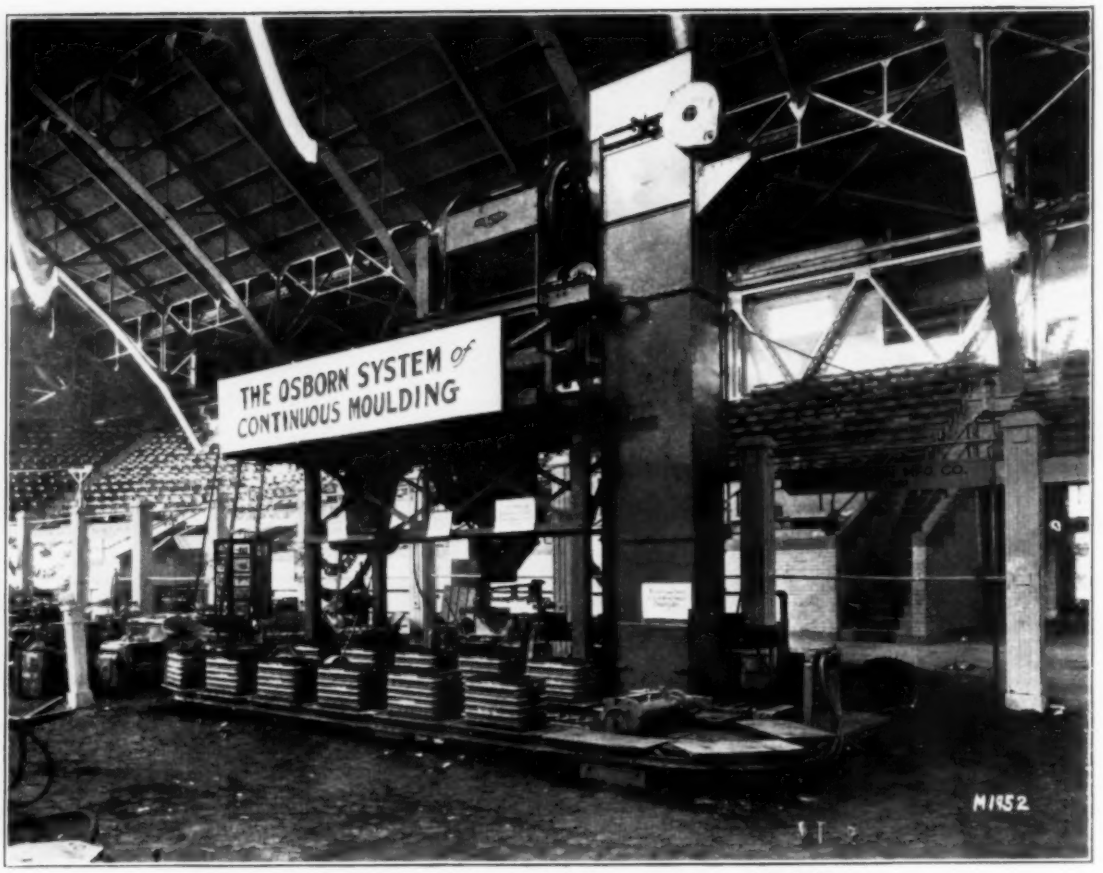
ISBECQUE TODD & CIE
Brussels, Belgium

J. W. JACKMAN & CO., LTD.
London, England
Manchester, England

A Complete Line of Foundry Moulding Machines

OSBORN

Sand Treating and Handling Equipment for Foundries



The Osborn Exhibit at the A. F. A. Convention and Exhibition, Detroit, 1926

Continuous Moulding

We could tell you about any one of a number of large, successful installations of Osborn continuous moulding, sand treating and handling systems, but most foundrymen will get a better picture of the Osborn system by recalling the Osborn continuous moulding unit at the Detroit Convention last year.

The photograph above shows this unit which includes all of the essentials of a practical working installation condensed into the smallest possible space for the exhibit. As a matter of fact, it has since been purchased by one of the leading New England foundries with only minor alterations to change it from an

A Complete Line of Foundry Moulding Machines

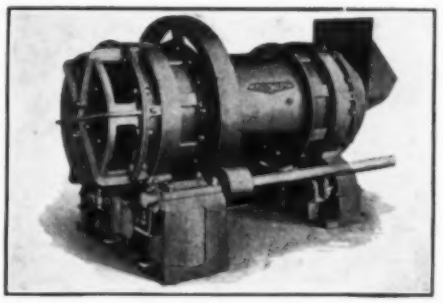
OSBORN

Sand Treating and Handling Equipment for Foundries

exhibit unit to a working unit.

You will recall that as the moulds were completed, at a rate of more than one a minute, they were carried away by the power conveyor—and how after they had been shaken out at the jolt shakeout position the flasks were returned by gravity and the sand returned to the storage bins over the moulding machines after being conditioned.

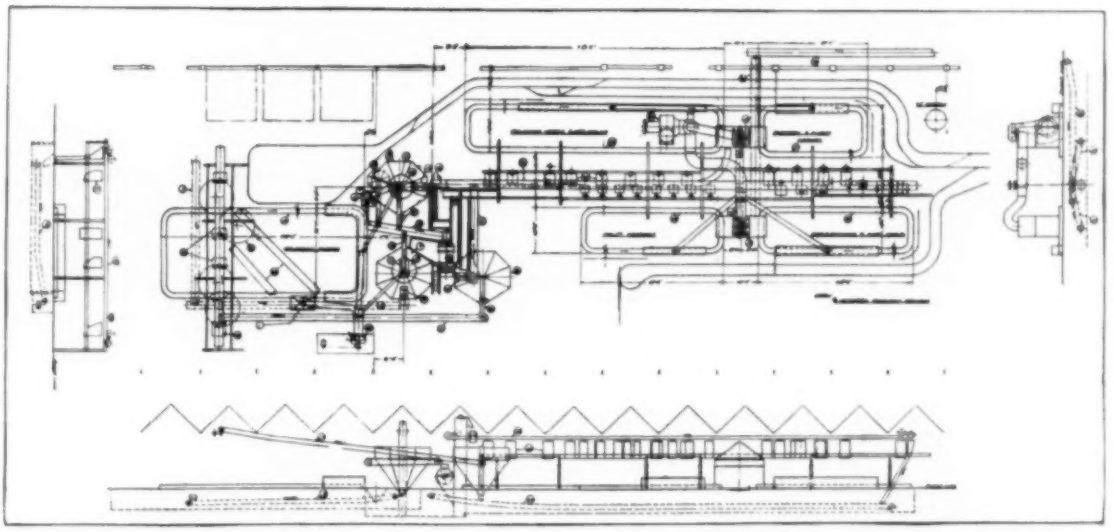
The Osborn Sand Treating Mill is included in most installations of the Osborn system of continuous moulding. It is shown at the right.



Osborn Sand Treating Mill
(Continuous Type)
Capacities from twenty to sixty-five tons per hour

At the bottom of this page is a typical Osborn layout. This system was designed to meet the conditions and problems in one of the most prominent foundries in this country. It has been saving them money at a rate of tens of thousands of dollars a year—larger savings than we estimated or they hoped for.

Osborn's unbroken record of successes causes most straight thinking foundrymen to call in an Osborn Engineer before deciding on a system of continous moulding.



A Typical Osborn Layout For a Continuous Moulding System
Now Operating Successfully

A Complete Line of Foundry Moulding Machines

OSBORN

Sand Treating and Handling Equipment for Foundries

Nos. 74-J, 75-J, and 76-J
Osborn Jolt Squeezer Moulding Machines
(Air Operated)

This standard line of Osborn Squeezer Machines has been working in production foundries for the past 14 years. In fact the first lot manufactured are still in active service in a progressive Detroit Automobile plant. Many large plants operate more than a hundred of these Osborn machines. The various sizes, 8½", 10" and 13" squeeze cylinders, are adaptable to all classes of work from small non-ferrous moulds to steel moulds.

Nos. 274-J and 275-J
Osborn Jolt Squeezer Moulding Machines
(Air Operated)

These are the newly designed Osborn Squeezer machines which are being successfully used in almost 100 progressive foundries. They are fast, accurate and durable and built to the exacting Osborn standards. Machines of this type have been in use long enough to be well past the experimental stage and yet are of recent, modern design incorporating all of the most recent advantages—including low price.

No. 275-JW Osborn Jolt Squeezer Moulding Machine
Sand Straddler Type
(Air Operated)

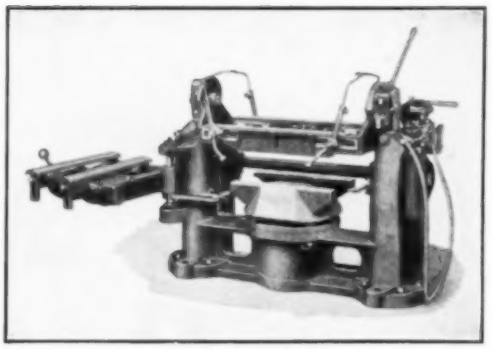
There is a growing tendency to study each Squeezer job carefully and to employ the moulding method that will yield the highest production per man per day. Moulds that are heavy or awkward to carry to the floor can best be made in maximum quantities with minimum spoilage by using this portable machine. It is easier to move this really portable machine than to carry large moulds away from it. Many foundries are making from 10% to 25% more moulds with this machine than formerly obtained with a stationary machine.

Operating in one or more of the foundries listed for plant visitation at the A. F. A. Convention, Chicago, 1927.

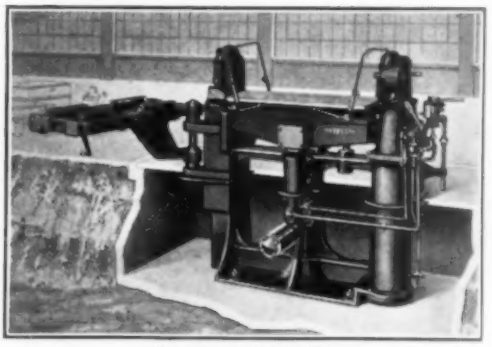
A Complete Line of Foundry Moulding Machines

OSBORN

Sand Treating and Handling Equipment for Foundries

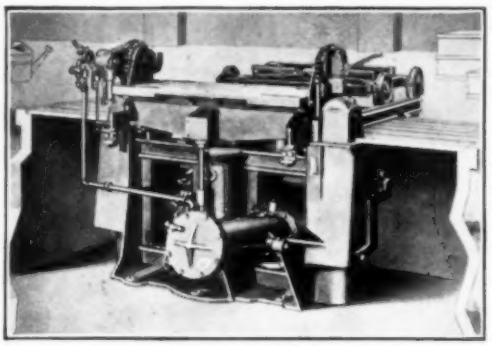


No. 401 and 402
Osborn Jolt, Rollover, Pattern Draw Moulding Machines
30″—36″ long
(Air Operated)

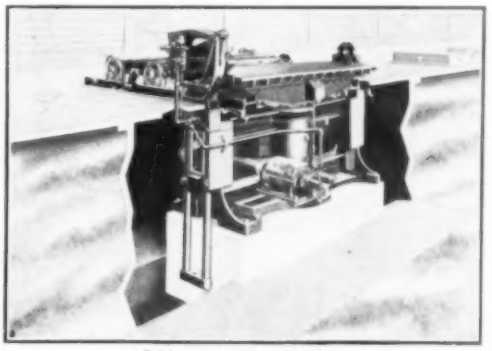


No. 403 and 403-W
Osborn Jolt, Rollover, Pattern Draw Moulding Machines
44″—52″ long
(Air Operated)

The four pictures on this page illustrate the complete line of Osborn Jolt Rollover Pattern Draw Moulding Machines. Each size is built to the same exacting Osborn standards of convenient operation and rugged construction. In all sizes the pattern draw is accurate to within .0005″ per inch of draw. The mould is rolled over on the approximate center of gravity, requiring a minimum of power and with minimum stress and strain on the machine. Each is self-contained in a heavy one-piece housing fitted with replaceable bushings at the points of the greatest wear. The Osborn adjustable jolt feature is incorporated in all from the smallest 30″ machine to the largest which takes a 13 foot flask.



* Nos. 404 to 406
Osborn Jolt, Rollover, Pattern Draw Moulding Machines
54″ to 78″ long



* Nos. 505-E to 517-E
Osborn Jolt, Rollover, Pattern Draw Moulding Machines
68″ to 13′ long
(Electrically Operated Except for Air Operated Jolt)

Osborn Jolt Rollover Pattern Draw Moulding Machines have a dual use in the foundry. For quantity production of moulds they are standard units in many of the leading automotive plants and other high production foundries—used either with or without conveyor systems.

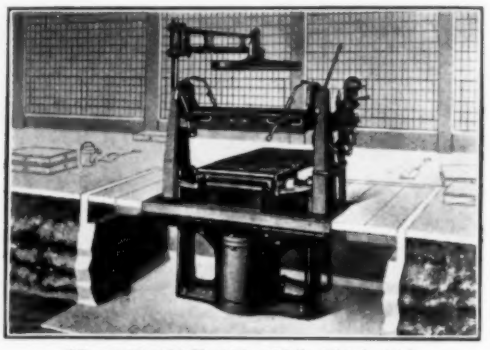
The second use of these machines is for jobbing work—both copes and drags. Patterns may be arranged to be changed quickly and much labor saved even when making a few moulds per day from each of many patterns.

*Operating in one or more of the foundries listed for plant visitation at the A. F. A. Convention, Chicago, 1927.

A Complete Line of Foundry Moulding Machines

OSBORN

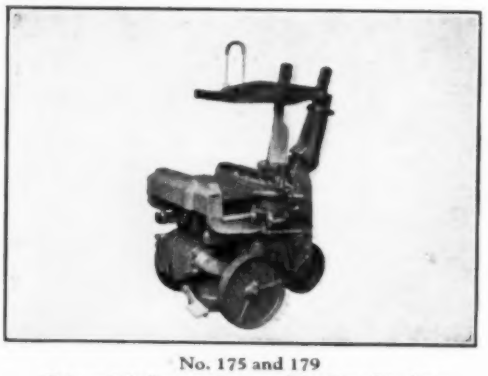
Sand Treating and Handling Equipment for Foundries



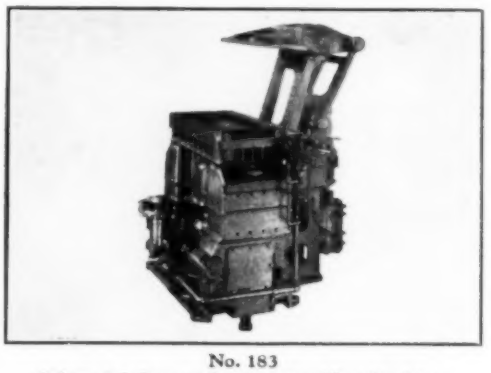
Nos. 321, 321-D, 322, 322-L, 323-A, 324
Osborn Jolt, Rollover, Squeeze, Pattern Draw Moulding Machines. (With Roller Conveyor Attachment)
(Air Operated)

Nos. 421, 421-D, 422, 422-L, 423-A, 424
Osborn Jolt, Rollover, Squeeze, Pattern Draw Moulding Machines. (With Swing Out Frame)
(Air Operated)

These two machines are modifications of the same type. They are the fastest drag machines on the market today. They jolt ram the mould, provide means for accurate, mechanical strike off, quick clamping, easy roll over, squeezing the bottom board in place and then automatically drawing the pattern. They differ only in the method of disposing of the mould—one by roller conveyor, the other by swing frame. These are high production machines, built for long, accurate service under the most exacting conditions—as with continuous moulding units.



No. 175 and 179
Osborn Jolt Squeeze Stripper Moulding Machines
(Air Operated)



No. 183
Osborn Jolt Squeeze Stripper Moulding Machines
(Air Operated)

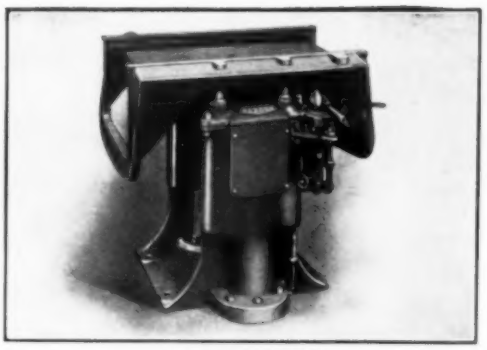
The most rapid type of cope machines on the market today. They are built in 10″ to 30″ squeeze cylinder sizes, and differ only in details of construction. All sizes jolt ram the mould, complete the ramming by squeezing and then draw the pattern automatically on the down stroke of the squeeze piston. Heavy, rugged, sand-shielded construction throughout and liberal design of parts insure long accurate life.

Operating in one or more of the foundries listed for plant visitation at the A. F. A. Convention, Chicago, 1927.

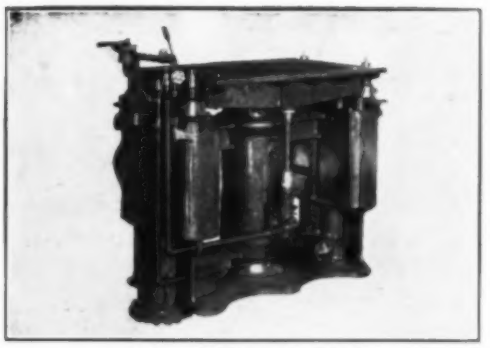
A Complete Line of Foundry Moulding Machines

OSBORN

Sand Treating and Handling Equipment for Foundries

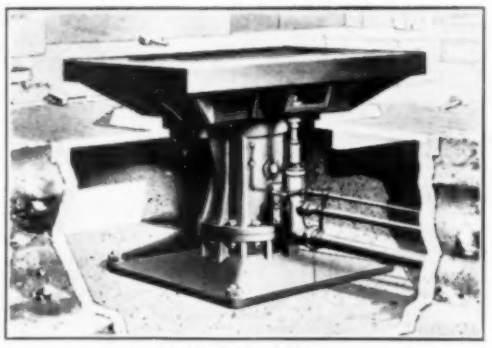


No. 549 and 550
Osborn Jolt, Stripper Moulding Machine
(With Open-end Lifting Frame)
(Air Operated)

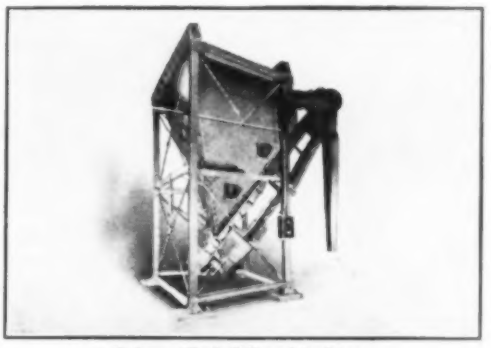


Nos. 404-S, 405-S, 406-S
Osborn Jolt, Stripper Moulding Machines
(Air Operated)

The two machines above are typical of the Osborn line of Jolt Stripper Moulding Machines. This line of machines is made from the small No. 549 machine up to large machines 13 feet in length. All sizes give the long, accurate, dependable service that is associated with the name "Osborn". All are designed for use with stripping plate patterns in production units. The smallest sizes are also furnished with open-end lifting frames for making miscellaneous copes on a jobbing basis.



Nos. 98 to 110
Osborn Plain Jolt Moulding Machines
(Air Operated)



Osborn Flask Filling Machines
(Electrically Operated)

This machine is representative of the complete line of Osborn Plain Jolt Moulding Machines ranging from 200 lbs. to twenty tons capacity. All are equipped with the Osborn adjustable jolt valve which controls the length of stroke and quality of jolt blow. All are of heavy rugged construction and built with extra long jolt pistons.

The Osborn flask filling machine is the only machine on the market that will distribute sand into the flask at a rate of from one to two cubic yards of sand per minute. The sand storage bin may be of any capacity, located either above or below the floor, and arranged for filling by various methods.

Operating in one or more of the foundries listed for plant visitation at the A. F. A. Convention, Chicago, 1927.

A Complete Line of Foundry Moulding Machines

OSBORN

Sand Treating and Handling Equipment for Foundries

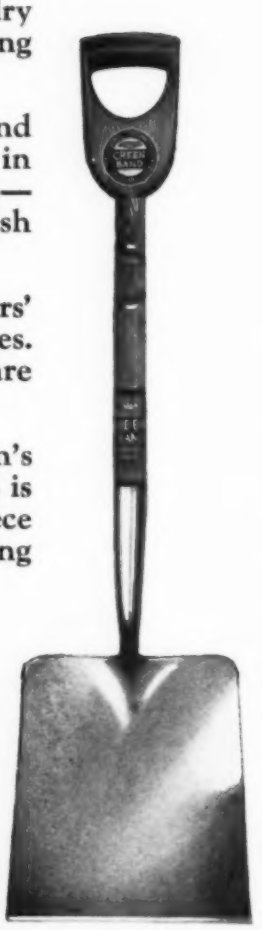
Better Wearing and Better Working Osborn Foundry Tools

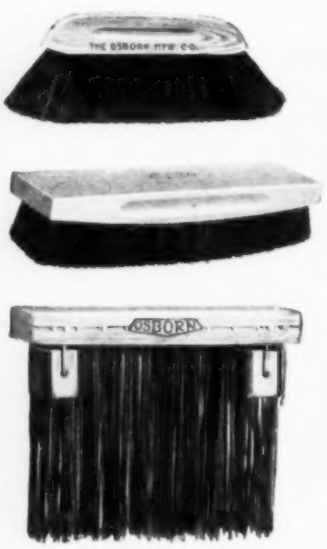
Throughout the foundry industry Osborn foundry tools enjoy the same reputation as Osborn Moulding Machines—they are the standards of quality.

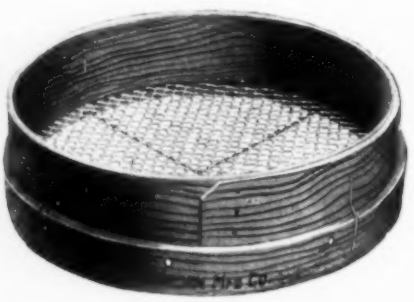
Take, for example, the Osborn Improved Green Band Shovel. This fully heat-treated shovel is standard in hundreds of foundries. It is virtually indestructible—splitting at the point is eliminated and its extra polish makes scouring easy.

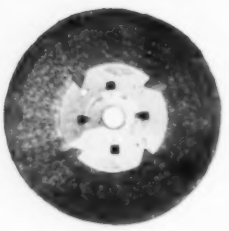
Osborn manufactures a complete line of Moulders' Brushes, Casting Brushes and Wire Wheel Brushes. Other items which are used day in and day out are Osborn Riddles and Bellows.

Throughout this entire line is again reflected Osborn's intimate knowledge of foundry requirements. This is the secret of the widespread popularity of every piece of foundry equipment and every foundry tool bearing the Osborn trademark.









THE OSBORN MANUFACTURING COMPANY
INCORPORATED

5401 Hamilton Ave. Cleveland, Ohio, U. S. A.

A Complete Line of Foundry Moulding Machines

OSBORN

Sand Treating and Handling Equipment for Foundries

Continuous Performance

At Unusually High Economy

The Campbell, Wyant and Cannon foundry produces a very heavy tonnage of finished automobile castings. Competition in this field demands an unusually high efficiency in all departments.

They have lately installed three I-R oil-engine-driven Air Compressors. The entire plant is running 24 hours a day with but a short shut-down period for inspection on Sundays. The owner already reports *a very satisfactory saving.*

The Ingersoll-Rand oil-engine-driven Compressor is available in sizes with 350, 600, and 900 cu. ft. displacement per minute. Other Ingersoll-Rand Air Compressors, however, are furnished as belted units or direct-connected to electric motors or steam or gas engines. These can be held in sizes ranging from 7 to 7440 cu. ft. per minute displacement.

Ingersoll-Rand engineers are always at the service of Compressed Air users. They can often point out the means to greater economy.

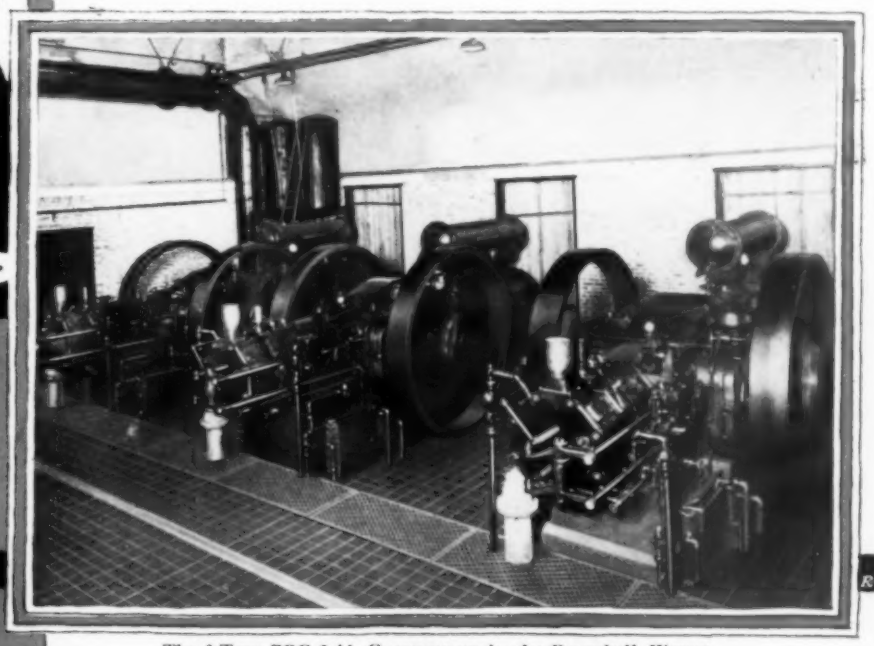
The I-R line of Pneumatic Equipment includes sand rammers, chippers, grinders, hoists, and compressors of all kinds. Let us quote on your requirements.

INGERSOLL-RAND COMPANY

11 Broadway - - - New York City

Offices in principal cities the world over

For Canada Refer—Canadian Ingersoll-Rand Co., Ltd.
11 Phillips Square, Montreal, Quebec



The 3 Type POC-2 Air Compressors in the Campbell, Wyant and Cannon Foundry, Muskegon, Michigan.

Ingersoll-Rand

108-SOE

Chicago Foundries Reveal *Industry's Progress*

CHICAGO, the second city in the United States measured by the number of inhabitants living within its confines, also enjoys the distinction of being the largest casting manufacturing center in America, if not in the world. More than 200 foundries, located within the city, probably pour a greater tonnage of iron and steel than the shops in any other city, and at the same time produce a heavy tonnage of nonferrous castings.

Growth of the foundry industry in the midwest metropolis, built on the marsh land bordering the southern shore of Lake Michigan, has been due primarily to the strategic location of the city. In the early days of Chicago several towns along the Mississippi boasted of a greater population and more commercial activity. However, it soon became apparent that Chicago was destined to become the commercial center of that fertile agricultural section of the Mississippi valley, and later the gateway to the West. As the sturdy pioneers moved westward from the states along the Atlantic seaboard and cleared the land for a home in the forests of the midwest, Chicago, because of its central location and accessibility, became the distributing point for necessary supplies and equipment.

At first, agricultural implements were purchased in the East and distributed through Chicago. As the demand grew small companies began manufacturing implements in that city. Since castings constitute a major item in agricultural implements, small foundries became a necessary part of these first farm implement manufacturing companies. In the years that followed, several Chicago men invented and perfected agricultural equipment which has eased the labor of mankind and placed their names in the hall of fame for all generations to admire. These inventions created a greater demand for implements and Chicago became a leader in the manufacture of machinery needed by farmers. Many foundries in the city today are making gray iron, steel, and malleable castings which eventually will assist in cultivating the crops for the world's food supply.

Chicago was the goal of the first railroads that bravely pushed west from the eastern coast. Nu-

¶ *Plant Visitation Programs Permit Convention Visitors To See Modern Shops in World's Largest Foundry Center*

merous consolidations were necessary before the great trunk lines were possible which today unite Chicago with Boston, New York, Philadelphia, and Baltimore. When the transcontinental railroad building boom developed shortly after the Civil war, Chicago became the starting point of the railroads' westward trend. Today Chicago is the greatest railroad center in the world with a total of 38 lines, all of which terminate within the city. It has been natural that the city should become the central market for much of the equipment used by these railroads and a number of foundries are engaged in making castings for all of the nation's railroads.

Diversified industry is the outstanding characteristic of Chicago today. Proximity to markets and raw materials and unexcelled transportation facilities have been instrumental in the establishment of companies manufacturing and merchandising a wide range of products. Since the city is situated in the center of a great iron and steel district, many of these manufactured items are produced from cast metals. Ten per cent of the foundry and machine products of the country come from within the city limits. In addition to the agricultural equipment and railroad supplies, a tremendous tonnage of metal is poured in castings for heating, plumbing, and domestic service specialties, electrical equipment, machine tools, ornamental iron, etc.

To obtain a true picture of the foundry industry in Chicago, it is necessary to include the various plants which are located in the famous industrial district surrounding the city. This consists of the territory bounded by the Chicago Outer Belt Line railroad and includes the towns of Aurora, Batavia, Chicago Heights, East Chicago, Elgin, Gary, Geneva, Hammond, Harvey, Indiana Harbor, Joliet, North Chicago, St. Charles and Waukegan. The latest edition of *Penton's Foundry List* enumerates 204 foundries in Chicago proper and a total of 269 foundries in the metropolitan district surrounding the city.

Members of the American Foundrymen's association attending the convention at the Edgewater Beach hotel, Chicago, from June 6 to 10, will be given the greatest opportunity for plant visitation in the history of the association. The wide diversification of products, the large amount of time which will be devoted to the visitation program, and the time and effort which has been put forth by the plant visitation committee composed of members of the Chicago Foundrymen's club, all proclaim this opportunity. The plants which will be open for inspection will be discussed later in more detail.

THE FOUNDRY recently conducted a survey of the plants in Chicago to secure information which may assist visitors in selecting the plants they would like to visit. The foundries in Chicago and surrounding towns together with addresses, kind of metal melted, class of castings manufactured, and the name of the president or general manager are tabulated on pages 30, 31 and 32 of this section.

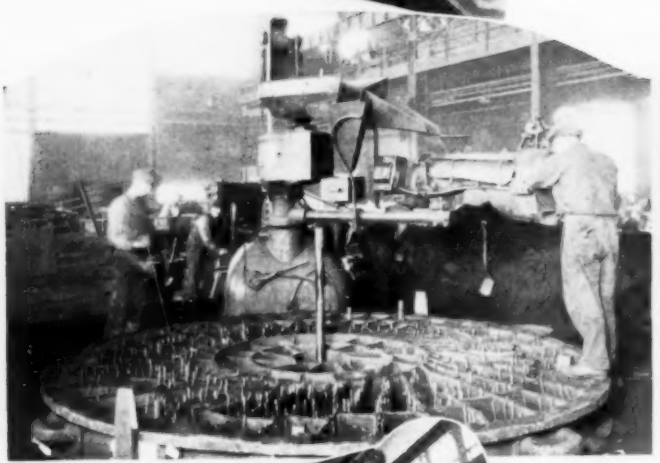
Older men in the industry will find many changes have taken place in the foundry industry

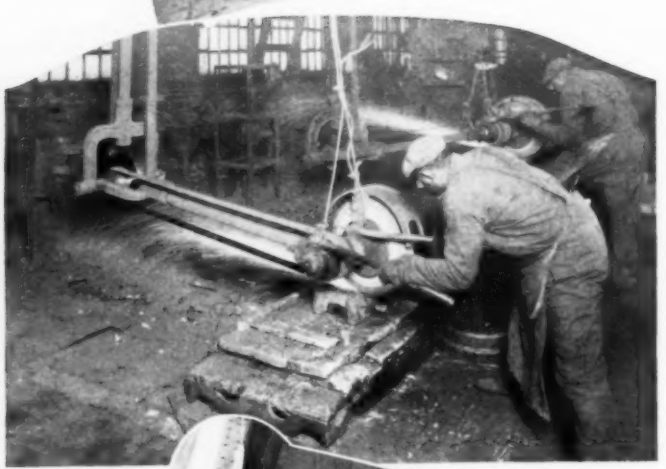
(*Continued on Page* 31)

Convention Open Doors

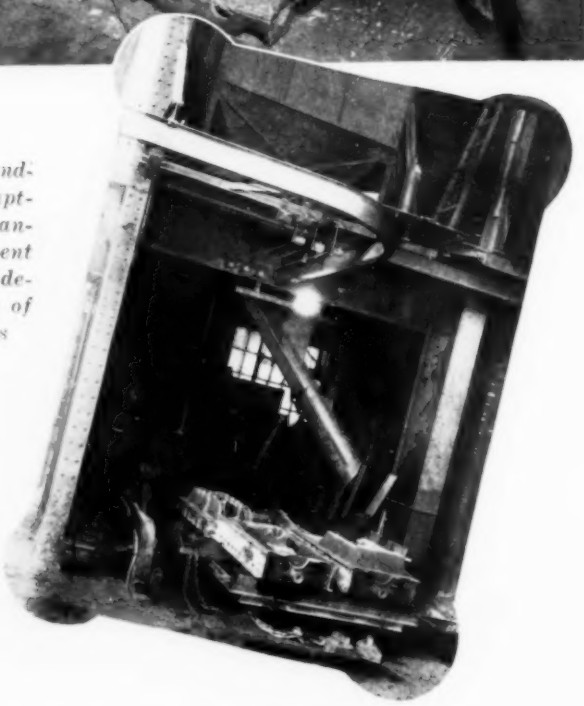
Convention visitors will find Chicago foundries using much modern equipment

Close attention has been paid to arranging molding floors for maximum production



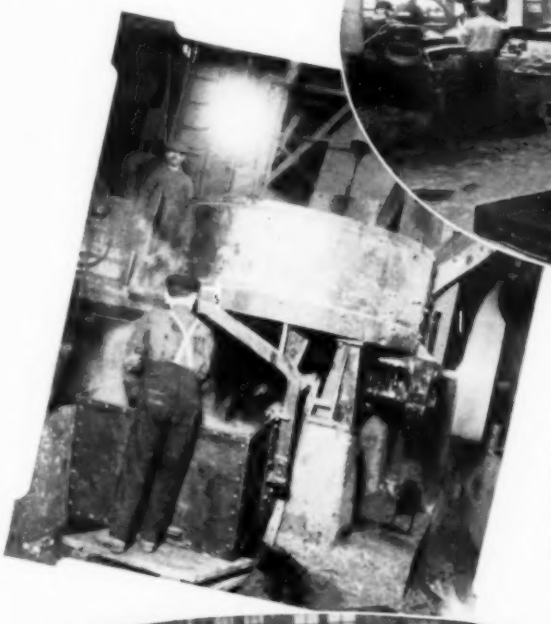


Chicago foundries have adapted material handling equipment to various departments of their plants



City Plants To A. F. A.

The bulk of Chicago's tonnage is poured into small castings of many types



Sand control problems are being solved and many plants operate laboratories to make daily sand tests

Practically every type of melting equipment known in this country will be found among the 200 foundries of the city

Chicago Shops Find Where Castings Are Sold

Roll Call of Foundries in the City of Chicago

Name	Metal Melted	Class of Casting	President or General Manager
A. B. C. Pattern & Foundry Co., 4021 W. Kinzie St.	Brass, aluminum	Patterns	F. H. Sheridan
A. & W. Brass Foundry, 525 Law Ave	Bronze, aluminum brass	Jobbing	Gus. Puck
Ace Foundry Co., 4349 W. Kinzie St.	Brass, bronze		W. Wilson
Acme Aluminum Foundry Co., 814 W. 75th St.	Aluminum	X-Ray machines, cleaners, cookware	S. B. Reihm
Adams & Westlake Co., 319 W. Ontario	Nonferrous	Railway, ship hardware	Thos. Holt
Advance Pattern & Foundry Co., 2734 W. 36th Place	Aluminum	Cooking utensils	Nels Shoan
Aermotor Co., 2500 W. Roosevelt Road	Gray iron	Agricultural	L. C. Walker
Agate Foundries Inc., 1725 Maypole Ave	Brass, aluminum, copper	Jobbing	D. H. Brownlee
All Metals Foundries Inc., 4029 W. Kinzie St.	Brass, bronze, aluminum nickel, silver, monel	Steam goods, auto fittings, hardware	F. C. Harding
W. D. Allen Mfg. Co., 5650 Roosevelt Rd.	Brass	Light Jobbing	W. D. Allen
Alloys & Brass Foundry Co., 4317 N. Western	Brass, aluminum	Jobbing	A. A. Stewart
Alloys Foundry Co., 1725 Walnut	Monel, nickel	Jobbing	C. B. Carter
American Art Bronze Foundry, 4921 W. Lake	Statuary bronze	Statuary	Jules Berchen
American Brake Shoe & Foundry Co., 332 S. Michigan Ave	Gray and white iron	Railroad castings	H. Wright
American Brass & Bronze Foundry, 411 S. Clinton	Brass, bronze, steel	Ornamental bronze	M. F. Purcell
American Building Foundry Co., 2300 S. Springfield Ave.	Gray iron		V. J. Houha
American Car & Foundry Co., 2417 S. Paulina	Gray iron	Railroad	W. H. Woodin
American Castings Co., 6843 S. Irving Ave.	Aluminum	Jobbing	A. Rosset
American Foundry & Furnace Co., 4750 Sheridan Rd.	Gray iron	Furnace	L. G. Whitmer
Anderson Bros. Brass Fdry., 1388 Fulton St.	Brass, bronze, aluminum	Machinery	L. A. Anderson
Andy Pattern & Foundry Co., 2222 W. Monroe St.	Brass, aluminum	Jobbing	A. Stychal
Armitage Pattern Works, 1925 Elston Ave.	Brass, aluminum, bronze	Jobbing	Earl L. Seiffert
Armour Institute of Technology, 3300 Federal St.	Gray iron, bronze, aluminum		
Arrow Pattern & Foundry Co., 2720 W. Lake St.	Brass, bronze, aluminum	Jobbing	Fred Erickson
Art Aluminum Foundry Co., 3906 N. Western Ave.	Aluminum	Jobbing	A. Powers
Atlantic Chandelier Foundry, 155 Wendell	Brass, bronze	Chandelier castings	Jos. Miller
Bastian-Blessing Co., 240 E. Ontario St.	Brass, nickel	Soda fountain, welding and cutting apparatus	C. L. Bastian
Baumbach Mfg. Co., 1812 S. Kilbourn Ave.	Gray iron	Die sets	E. A. Baumbach
Beardslee Chandelier Mfg. Co., 216 S. Jefferson St.	Brass, bronze	Chandelier	F. R. Farmer
V. F. Bendixen Foundry, 2300 Bloomingdale Ave.	Gray iron	Ornamental	V. F. Bendixen
Beneke Mfg. Co., 21st & Rockwell	Brass, aluminum	Carburetors, plumbing	Henry Beneke
Birtman Electric Co., 4140 Fullerton Ave.	Aluminum	Vacuum cleaners	H. R. Butz
Board of Education, 646 So. Clark			
Brighton Foundry Co., 3306 S. Artesian Ave.	Gray iron	Jobbing	Philip Summers
M. Brucker, 820 No. Lincoln	Gray iron	Stove, furnace repairs	M. Brucker
Brumund Bros. & Hufker Brass Foundry Co., 4406 Carroll Ave.	Brass, bronze, aluminum	Jobbing	J. Hufker
Burnside Steel Foundry Co., 1300 E. 92nd Street	Steel	Jobbing, automobile	H. F. Wardwell
H. W. Caldwell & Son Co., 2410 W. 18th St.	Gray iron	Machinery	Chas. Piez
Calument Brass Foundry Co., 9362 Ewing Ave.	Brass, bronze, aluminum	Jobbing	Henry Lindrath
Central Brake Shoe & Foundry Co., 5330 W. 66th St.	Hard iron	Brake shoes	F. Van Inwagen
Chicago Aluminum Castings Co., 2647 Ogden Ave	Aluminum	Jobbing	H. E. & G. H. Horton
Chicago Art Bronze Works, 840 Exchange Ave.	Bronze	Art statuary	W. J. O'Conner
Chicago Brass Works, Inc., 220 W. Ohio St.	Brass, bronze, aluminum	Jobbing	P. H. Kelly
Chicago Faucet Co., 2712 No. Crawford Ave.	Brass	Plumbing	A. C. Brown
Chicago Foundry Co., 2028 N. Major	Gray iron	Jobbing	C. F. Wells
Chicago Iron Foundry Co., 2315 W. Austin Ave.	Gray iron	Machinery and ornamental	T. L. Arzt
Chicago Malleable Castings Co., 12000 S. Racine Ave.	Malleable iron	Jobbing	John T. Llewellyn
Chicago Steel Foundry Co., Kedzie Ave. & 37th St.	Steel	Jobbing	David Evans
Chicago Surface Lines, 230 So. Clark St.			
Christensen & Olsen Co., 218 N. Ann St.	Brass, bronze, aluminum	Ornamental, machinery	A. Christensen
City of Chicago, 3124 S. Sacramento Ave.			
James B. Clow & Sons, 2600 W. Lake	Brass	Plumbing	W. E. Clow
Adelbert E. Coleman, E. 37 & Stewart Ave.	Bronze, brass, iron	Ornamental	A. E. Coleman
Colonial Fireplace Co., 4611 Roosevelt Rd.	Gray iron	Stove plate	W. S. Gardner
Columbia Brass Works, 1301 W. Division St.	Brass	Plumbing	Herman Hoelscher
Crane Co., 836 S. Michigan	Gray iron, brass	Fittings, valves	R. T. Crane
Creamery Package Mfg. Co., 61 W. Kinzie St.	Gray iron, brass	Dairy equipment	E. W. Chandler
Cribben & Sexton Co., 680 N. Sacramento Blvd.	Gray iron	Stove plate	Geo. D. Wilkinson
Crown Stove Works, 4631 W. 12th Pl.	Gray iron	Stove plate	W. F. Rogers
Cummings Casting Co., 4533 Patterson Ave.	Gray iron, semisteel	Jobbing	T. A. Cummings Jr.
Damez Foundry Co., 7380 S. Chicago Ave.	Gray iron	Ornamental, machinery	Lyman Damez
Dearborn Foundry Co., 345 W. 23rd St.	Gray iron	Electric light posts	L. G. Fargo
Eugene Dietzgen Co., Fullerton & Sheffield Ave.	Brass	Instruments	E. Dietzgen
Dole Valve Co., 1923 Carroll Ave.	Brass	Pipe fittings	A. R. Dole
Eberhardt & Wagner, 2011 Fullerton Ave.	Bronze	Ornamental	O. Wagner
R. M. Eddy Foundry Co., 372 W. Grand Ave.	Gray iron, semisteel	Jobbing	C. M. Eddy
Efficiency Device Mfg. Co., 2540 Lincoln Ave.	Aluminum		
Electrocast Steel Foundry Co., 4701 W. 15th Place	Steel	Jobbing	A. Dapogny
Elizabeth Street Foundry, 5833 S. Elizabeth St.	Gray iron, semisteel	Jobbing	A. W. Lemme
Elliott Foundry & Machine Works, 1921 S. Fairfield Ave.	Gray iron	Jobbing	
Excel Pattern & Foundry Co., 2906 Carroll Ave.	Brass, bronze, aluminum, special alloys	Matchplates, etc.	P. J. Murphy
Faunt Brothers Brass Foundry, 1555 Fulton St.	Brass, bronze	Bushings, bearings, gears	R. C. Faunt
Fearon Foundry Co., 1420 W. Kinzie St.	Gray iron	Machinery	M. J. Fearon
Federal-Huber Co., 127 No. Sangaman St.	Brass, white metal	Plumbing	D. A. Raymond
Ferguson & Lange Foundry Co., 1039 Willow St.	Gray iron, hard iron	Machinery	H. O. Lange
Francis & Nygren Foundry Co., 2542 Fillmore	Semisteel	Jobbing	Wm. Francis
General Brass Foundry Co., 224 N. Ada	Brass		F. Parizek
Goodman Mfg. Co., 4834 S. Halsted St.	Brass	Mining machinery	Chas. H. Strawbridge
Grabler Mfg. Co., 4600 W. Harrison St.	Malleable	Pipe fittings	M. C. Rosenfeld
Greenlee Foundry Co., 14th & Kenton St.	Gray iron, semisteel	Jobbing	C. B. Magrath
Gregory Electric Co., 16th & Lincoln	Copper, brass	Repair parts	A. L. Kuehmsted
Griffin Wheel Co., 445 N. Sacramento Blvd	Gray iron	Iron wheels	A. E. Domville
Hansell-Elcock Co., Archer & Normal Ave	Gray iron	Jobbing, machinery	E. G. Elcock
Hansen & Olsen Co., 506 S. Green St.	Copper, brass, bronze, aluminum	Electrical, jobbing	Oscar A. Hansen
Hanson Park Brass Foundry, 2130 N. Major Ave	Brass	Patterns	J. M. Michel
Arthur Harris & Co., 212 N. Curtis St.	Brass, bronze	Machinery	Arthur J. Harris
Hartnett Foundry, 300 W. Ontario St.	Aluminum, brass, bronze	Jobbing	B. Emmet Hartnett
Herbert Boiler Co., Root & LaSalle	Gray iron, semisteel	Boiler castings	Wm. Herbert
Hills-McCanna Co., 2025 Elston Ave.	Nonferrous	Jobbing	A. H. Nayls
Hodgson Foundry Co., 2014 W. 13th St.	Brass, copper, bronze, aluminum	Blast furnace, machinery	John W. Hodgson
Home Stove & Foundry Co., 2600 W. 18th Pl.	Gray iron	Stove plate	R. H. Morrish
C. H. Hoppe, 373 W. Grand	Gray iron		C. H. Hoppe
Hubbard Portable Oven Co., 1134 Belden Ave.	Gray iron	Ovens	
Hunter & Co., 1907 Indiana Ave.	Brass, aluminum	Jobbing	G. M. Fabian & P. F. Berany
Illinois Engineering Co., Racine Ave. & 21st St.	Nonferrous	Steam specialties	C. H. Matchet

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(*Continued from Page* 27)

in Chicago since the convention of the American Foundrymen's association was last held there in 1914. Progress which has been made in the industry throughout America is exemplified in this district bordering Lake Michigan. Leaders of the industry have been quick to apply the improved practices, which, in recent years have been developed through liberal interchange of ideas. Modern foundry equipment, the salvation of the foundryman in producing a better product at a lower cost, has been purchased freely by the great body of progressive foundrymen of Chicago.

In addition, Chicago foundrymen have made major contributions toward the upbuilding of the industry generally. Through participation in technical programs held under the auspices of the various associations sponsored by the foundry industry and contributions to the technical press, developments in foundry practice in the great midwestern city have been given to the world. Chicago foundrymen have assisted in shaping the policies of the American Foundrymen's association since its inception. Many developments in various types of foundry equipment have resulted from the work of equipment manufacturers in Chicago and the surrounding district.

Foundries of the district have gone deeply into the problem of preparing sand properly. Practically every type of machine for preparing sand for the molding floor may be found in the district. In addition, a number of foundries engaged in production work, have installed various types of handling equipment in connection with the sand preparing machines. A number of sand testing laboratories have been established to control sand for the daily run.

Although several Chicago foundries make large castings, the bulk of the tonnage is medium and light work. For that reason much of the molding in the plants in Chicago is accomplished on machines. Practically all

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Diversified Products Feature City's Plants

(*Concluded from Page* 30)

Name	Metal Melted	Class of Casting	President or General Manager
Illinois Malleable Iron Co., 1801 Diversey Blvd.	Malleable, gray iron	Jobbing	Geo. J. Reeling
Illinois Steel Co., 3426 E. 89th St.	Steel	Steelworks	E. S. Buffington
Imperial Brass Mfg. Co., 1200 Harrison St.	Brass, aluminum, bronze, copper	Welding, automobile	Wm. Dobrick
International Harvester Co., 606 S. Michigan Ave.	Malleable, gray iron	Agricultural	R. G. Brooks
Interstate Foundries Inc., 5939 West 66th	Steel	Jobbing	J. L. Morrow
Johnston & Jennings Co., 1030 W. 38th St.	Hard iron	Sashweight, elevator weights	T. J. Calhoun
W. A. Jones Foundry & Machine Co., 4401 W. Roosevelt Rd.	Gray iron	Machinery	W. G. Jones
Kainer & Co., Inc., 76 N. Mather St.	Brass, bronze, aluminum nickel, silver	Marine hardware, jobbing	F. T. Kainer
Kedzie Foundry Co., 3236 W. 31st St.	Semi-steel	Steam fittings, kettles	G. Erlandson
P. S. & J. E. Kelly Brass Fdy., 220 West Ohio St.	Aluminum, brass	Jobbing	P. S. Kelly
Kelly Brass Works, 226 W. Ontario St.	Brass, bronze, aluminum	Jobbing, valves	F. W. Leuthesser
W. W. Kimball Co., W. 26th & Marshall Blvd.	Gray iron	Piano plate	C. N. Kimball
Kling Brothers Engineering Works, 1300 N. Kostner Ave.	Gray iron	Machinery	Olaf E. Kling
R. Lavin & Son, 2511 W. 21st St.	Brass, copper		
Leitelt Brothers, 7731 S. Chicago Ave.	Brass, bronze, aluminum	Tablet work	Chas. F. Leitelt
Henry Lindahl Machine Co., 954 W. Lake Ave.	Gray iron	Machinery	Henry Lindahl
Link-Belt Co., 910 S. Michigan	Gray iron, steel	Machinery	Alfred Kauffmann
Liquid Carbonic Co., 3100 S. Kedzie Ave.	Brass, bronze	Machinery	Mr. MacIntosh
McCarthy Foundry Co., 3307 S. Lawndale Ave.	Gray iron		W. F. McCarthy
Magnus Metal Co. Inc., 2234 W. 43rd St.	Brass alloys	Bearings	W. H. Croft
Louis Meskan Brass Foundry, Inc., 2902 Carroll Ave.	Nickel, lead, brass	Jobbing	Louis Meskan
A. Meskan Chandelier Foundry Co., 5119 W. Lake Ave.	Brass	Lighting fixtures	A. Meskan
Mid-City Foundry Corp., 945 W. 49th Place	Gray iron, semisteel	Jobbing	L. Dahlberg
Midwest Brass Foundry, 552 W. Lake	Brass, aluminum, monel	Jobbing	J. Scerlong
C. H. Milles Foundry Co., 2201 W. 35th St.	Gray iron	Machinery, ornamental	C. H. Milles
Monaco Metal Foundry Co., 1119 W. Grand	Brass, bronze, aluminum	Jobbing	Steven Monaco
Monighan Foundry Co., 2135 Carroll Ave.	Gray iron	Jobbing	John Monighan
National Malleable & Steel Castings Co., 2610 W. 25th Pl.	Malleable, steel	Automobile and railroad	H. F. Pope
Niagara Radiator & Boiler Co., Woodlawn & E. 83rd	Gray iron	Radiators	E. C. Andrew
Nichol-Straight Foundry Co., 319 W. Austin Ave.	Gray iron	Jobbing	D. N. Gellert
North Western Foundry Co., 731 Bunker St.	Gray iron		C. B. Magrath
Nugent Steel Castings Co., 3100 S. Wood St.	Carbon and alloy steels	Automobile, railroad	W. J. Nugent
O'Malley-Beare Valve Co., 255 E. 95th St.	Brass	Valves	C. S. Pope
Paragon Metal Products Co., 5100 W. 16th	Brass, bronze	Railroad	H. S. Schroeder
Pettibone Mulliken Co., 4710 Division St.	Manganese, carbon steel, gray iron	Railroad	A. M. Cornell
F. J. Phillips & Son, 616 W. Monroe St.	Aluminum, brass	Automobile	F. J. Phillips
Phoenix Foundry Co., 1455 S. Jefferson	Malleable	Elevators	L. Samuels
A. Plamondon Mfg. Co., 5301 S. Western Blvd.	Gray iron		J. T. Benedict
Pullman Car & Mfg. Co., 79 E. Adams	Gray iron, brass	Railroad	D. A. Crawford
Pyle-National Co., 1334 N. Kostner Ave.	Iron, brass, aluminum		L. H. Vilas
Pyott Foundry Co., 328 N. Sangamon St.	Gray iron		A. E. Pyott
Quaker Mfg. Co., 215 N. Michigan Ave.	Gray iron	Furnaces, stoves	A. D. Farwell
Ravenswood Brass Foundry Co., 3159 Elston Ave.	Brass, bronze, aluminum	Jobbing	E. H. Kortum
Reder Foundry Co., Oakley Ave. & 35th Pl.	Gray iron	Jobbing	Adam Reder
Herman H. Reuter Foundry, 1316 W. 63rd	Brass, aluminum	Ornamental	Herman H. Reuter
Riverside Iron Works, 10640 Buffalo Ave.	Gray iron, semisteel	Jobbing	R. Kaufmann
Robey Foundry Co., 5817 So. Robey	Gray iron	Jobbing	C. Braschet
Roos Foundry, Inc., 1749 Ballou St.	Gray iron	Machinery	W. Hansen
Schlangen Bros. Co., 2435 Irving Park Blvd.	Brass, bronze, aluminum		N. A. Schlangen
Semi Steel Test Foundry Co., 4916 Bloomingdale	Semisteel	Ice making machinery	Geo. T. Wolf
Sheffield Foundry Co., 2021 Herndon St.	Gray iron	Machinery	E. F. Zitzewitz
Sigler-Dick Co., 25 W. Kinzie St.	Aluminum	Jobbing	R. G. Sigler
Sloan Valve Co., 4300 W. Lake St.	Brass	Valves, plumbing	Wm. Sloan
Smeeth Harwood Co., 2401 W. 22nd	Copper	Copper cooling castings	Mrs. Jennie H. Smeeth
E. P. Smith Wire & Iron Works, Fullerton & Claiburn	Iron, bronze	Ornamental	
Jas. L. Sparks Brass Works, 1725 Carrol	Brass, aluminum, bronze	Jobbing	Jas. L. Sparks
Street & Kent Mfg. Co., 1956 Clybourn	Brass	Plumbers supplies	W. J. Street
J. Streic & Co., 2159 Blue Island Ave.	Brass	Lighting fixtures	Joe Streic
Stromberg Motor Devices Co., 58-68 E. 25th St.	Brass, aluminum	Carburetor parts	C. W. Stiger
Tarrant Foundry Co., 1338 Cortland	Iron, semisteel	Machinery	W. J. Michel
Thompson-Neaylon Mfg. Co., 3545 So. Morgan St.	Brass		P. C. Thompson
Troy Brass & Aluminum Foundry, 4301 W. Kinzie St.	Nonferrous	Jobbing	J. L. Sparks & Ben Chelini
Tuschall's Brass Foundry, 9130 Lowe	Brass, aluminum	Jobbing	J. Tuschall
Vierling Steel Works, 23rd & Stewart	Gray iron	Machinery	Robert Bennett
Vulcan Iron Works, 327 No. Irving St.	Gray iron	Steam hammers	J. Warrington
Wagner Brass Foundry Co., 1306 Elston Ave.	Brass	Chandeliers	
Western Electric Co., 48th Ave. & W. 22nd St.	Gray iron	Electrical apparatus	C. L. Rice
Western Foundry Co., 36th & Kedzie Ave.	Gray iron, aluminum	Jobbing	J. P. O'Neil
Wolff Mfg. Co., 2057 Fulton St.	Gray iron	Bath tubs, sanitary supplies	Wm. J. Wolley

Interesting Foundries Are Located in District

AURORA, ILL.

Aurora Foundry Co., Aurora	Gray iron, brass, aluminum	Jobbing	Joy Love
C. B. & Q. Foundry, Aurora	Gray iron	Railroad	G. G. Higbee
Divekey Foundry & Machine Co., Aurora	Gray iron, brass, aluminum	Jobbing	J. O. Divekey
Love Brothers, Inc., Aurora	Gray iron, brass, aluminum	Jobbing	Joy Love

BATAVIA, ILL.

Appleton Mfg. Co., Batavia	Gray iron	Jobbing, agricultural	Dan Nortwick
Batavia Foundry & Machine Co., Batavia	Brass, bronze, aluminum	Jobbing	
Challenge Co., Batavia	Gray iron	Farm machinery, jobbing	Frank Snow
Fox River Brass Mfg. Co., Batavia	Brass, bronze, aluminum	Jobbing	Wm. R. Anderson
Lindgren Foundry Co., Batavia	Semisteel, gray iron		E. E. Lindgren
C. W. Shumway & Sons, Batavia	Gray iron	Jobbing	H. G. Schumway
D. R. Sperry & Co., Batavia	Semisteel, gray iron		E. C. Brown
U. S. Wind Engine & Pump Co., Batavia	Gray iron	Agricultural, jobbing	H. N. Wade

CHICAGO HEIGHTS, ILL.

American Manganese Steel, Chicago Heights	Manganese steel	Jobbing	W. G. Nichols
Canedy-Otto Mfg. Co., Chicago Heights	Gray iron	Machine tools, ornamental	C. H. Thoman
Chicago Heights Brass Foundry, Chicago Heights	Brass, copper, aluminum	Jobbing	W. Piotrowski
D. G. Foundry Co., Chicago Heights	Brass, gray iron	Jobbing	Geo. Gawenis
Illinois Foundry & Specialty Co., Chicago Heights	Gray iron	Jobbing	J. P. O'Neil
Quaker Mfg. Co., Chicago Heights	Gray iron		

EAST CHICAGO, IND.

Calumet Foundry & Machine Co., East Chicago	Gray iron, brass, aluminum	Bushings, jobbing	Wm. H. Kleppinger
Edward Valve & Mfg. Co., East Chicago	Gray iron, monel, bronze, aluminum	Valves, washing machine parts	W. W. Crawford
Famous Mfg. Co., East Chicago	Gray iron		Martin Petersen
Green Engineering Co., East Chicago	Gray iron	Stoker, machinery	L. W. Klein
Hubbard Steel Foundry Co., East Chicago	Steel	Jobbing	J. T. Osler
Superheater Co., East Chicago	Brass, aluminum	Heaters	C. H. True

ELGIN, ILL.

Elgin Mfg. Co., Elgin	Gray iron, brass, aluminum	Machinery	L. W. Duer
Woodruff & Edwards, Co., Elgin	Gray iron	Jobbing	A. D. Edwards

GARY, IND.

Calumet Foundry & Machine Co., Gary	Gray iron, brass	Jobbing	Wm. H. Klippinger
Indiana Steel Co., Gary	Iron, steel, brass	Machinery	Wm. B. Gleason

GENEVA, ILL.

Diversey Foundry Co., Geneva	Gray iron		J. Rowbottom
Geneva Foundry & Machine Co., Geneva	Gray iron	Jobbing	C. A. Berg
W. H. Howell Co., Geneva	Gray iron	Jobbing	E. E. Ekvall

HAMMOND, IND.

Damascus Steel Casting Co., Hammond	Steel		I. C. Anderson
Hammond Brass Works, Hammond	Brass, aluminum	Valves	G. T. Lammering
Southern Wheel Co., Hammond	Gray iron	Wheels	Frank C. Turner
United Boiler Heating & Foundry Co., Hammond	Gray iron, brass, aluminum	Jobbing	C. N. Nau
Wanner Malleable Castings Co., Hammond	Malleable	Railroad, automobile	H. C. Wanner

HARVEY, ILL.

Allied Steel Casting Co., Harvey	Steel	Railroad	J. T. Llewellyn
Buda Co., Harvey	Gray iron, brass	Gas engine and automobile	L. M. Giles
Wm. E. Dee Co., Harvey	Gray iron	Jobbing, machinery	Wm. E. Dee
Pettigrew Foundry Co., Harvey	Gray iron		F. R. Craig
Whiting Corp., Harvey	Gray iron, steel, bronze	Jobbing	T. S. Hammond

INDIANA HARBOR, IND.

Aluminum & Brass Foundry Inc., Indiana Harbor	Aluminum, brass		
American Steel Foundries, Indiana Harbor	Steel	Railroad	R. P. Lamont

JOLIET, ILL.

H. Humphrey & Sons, Joliet	Gray iron	Jobbing	Charles Humphrey
Illinois State Prison Foundry, Joliet	Gray iron, brass		
Illinois Steel Co., Joliet	Gray iron, steel	Steelworks	E. J. Buffington
Inland Iron Works, Inc., Joliet	Gray iron, bronze		R. H. Thomas
Joliet Mfg. Co., Cass St. at Younger Ave	Gray iron	Agricultural jobbing	A. S. Witwer
Moore Brothers Co., Joliet	Gray iron	Stove plate	L. E. Moore
Wm. E. Pratt Mfg. Co., Joliet	Malleable	Hardware specialties	Wm. E. Pratt

NORTH CHICAGO, ILL.

Chicago Hardware Foundry Co., North Chicago	Gray iron, brass, aluminum	Jobbing	E. B. Sherwin
Gibson Brothers Mfg. Co., North Chicago	Brass	Waterworks	T. C. Gibson
Sager Lock Co., North Chicago	Brass	Locks	C. W. Sager
Waukegan Foundry Co., North Chicago	Gray iron, semisteel	Machinery, jobbing	A. K. Barr

ST. CHARLES, ILL.

Crown Electric Mfg. Co., St. Charles	Brass	Lighting fixtures	H. B. Hempstead
Moline Malleable Iron Co., St. Charles	Malleable, steel	Chain links, jobbing	R. R. Fauntleroy
St. Charles Fixture Mfg. Co., St. Charles	Brass, aluminum	Lighting fixtures	Hugh A. Stewart

WAUKEGAN, ILL.

Electric Household Utilities Corp., Waukegan	Gray iron, aluminum	Machinery	S. D. Heed
General Boilers Co., Waukegan	Gray iron, brass	Boilers	O. T. Nelson
J. S. Heath Co., Waukegan	Copper, brass	Architectural	J. S. Heath

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types of molding machines, from small to large, are in use in Chicago. In a number of plants the machines are built to function with the sand preparing, conveying and distributing system.

Foundrymen interested in studying various types of melting equipment in operation will find Chicago a fertile field. Numerous electric furnace installations have been made in both ferrous and nonferrous foundries. Several plants engaged in making plumbing supplies and other nonferrous castings have large batteries of oil and gas fired furnaces, of both the crucible and noncrucible types. Cupolas, air furnaces, open hearths and converters also will be found in the district.

Considerable attention has been paid to modernizing cleaning rooms by installing the latest equipment. Various types of sandblast and dust arrester units, tumbling barrels and grinders will be found. In many plants the nature of the work requires portable chipping hammers and grinders. Space will not permit enumerating all equipment that may be seen in the plants of the metropolitan district. However, it may be said that equipment in Chicago district plants represents the latest developments in the industry.

A complete program for group plant visitation has been arranged by the committee and is presented in the accompanying box. Perhaps a brief picture of the various plants on the program will assist visiting foundrymen in selecting foundries which will be of greatest interest.

To Inspect Plants

Monday, June 6

Pettibine Mulliken Co., 4710 West Division street.
Nugent Steel Castings Co., 3100 South Wood street.

National Malleable & Steel Castings Co., 1400 South 52nd avenue.
W. A. Jones Foundry & Machine Co., 4401 West Roosevelt road.

International Harvester Co., McCormick Works.
Western Foundry Co., 3624 South Kedzie avenue.
Hansell Elcock Co., 3153 South California street.

Friday, June 10

Hubbard Steel Foundry Co., East Chicago, Ind.
Whiting Corp., Harvey, Ill.
American Steel Foundries, Indiana Harbor, Ind.

Sloan Valve Co., 4300 West Lake street.
James B. Clow & Sons, Talman & West Lake streets.
Imperial Brass Mfg. Co., 1200 West Harrison street.

The Pettibone Mulliken Co. operates an exceptionally interesting foundry for the production of railroad castings, such as switches, frogs, and crossings, from manganese and carbon steel and semisteel. Metal is melted in a cupola and three electric furnaces, one having a capacity of 2 tons and two of 3 tons each. The plant is equipped with an extensive system for handling and preparing the molding sand. Thirteen cranes of various types ranging in capacity from 3 to 15 tons, and 8 hoists are employed in handling materials in the foundry. Cores are baked in 9 core ovens and the castings are annealed in 5 annealing furnaces, one of which is fired by oil, two by gas and one by electricity. The cleaning department is complete with sandblast and tumbling equipment and a number of grinders. This plant was described in the Feb. 15, 1925 issue of THE FOUNDRY.

Light and medium weight castings for automobiles, railroads, etc., are produced by the Nugent Steel Castings Co., from steel melted in a battery of three electric furnaces. Much of the work in this modern plant has been adapted to molding machines and the molding sand is handled on a complete conveyor system. A large core department is maintained with a battery of 12 ovens and materials are transported about the plant by 5 cranes and numerous electric trucks. A description of methods of distributing costs at this plant appeared in the March 15, 1924 issue of THE FOUNDRY.

Miscellaneous steel castings ranging in size from one to 100,000 pounds, rolls and other jobbing work are manufactured at the Hubbard Steel Foundry Co., East Chicago, Ind. Metal is melted in 3 open-hearth and 3 air furnaces. While much of the work is large, the company utilizes a large number of molding machines in plant No. 2, which is devoted to the smaller work. Materials in the shop are handled with approximately 25 cranes and 15 hoists. Refuse sand is carried from the foundry floor to cars on the sidetrack along the side of the building with a special belt conveyor.

Western Foundry Co. produces miscellaneous jobbing castings of gray iron and aluminum. Practically all of the work at this shop is turned out on molding machines, 200 being in use, and the metal is melted in 5 cupolas and two aluminum furnaces. The cleaning department of this interesting shop is exceptionally complete with approximately 50 tumbling barrels, and six sandblast units.

The Whiting Corp. operates a general jobbing shop at Harvey and makes gray iron, steel, brass and aluminum castings. Much of the tonnage produced by this company is used in the manufacture of its line of foundry equipment. The American Steel Foundries, Indiana Harbor, Ind., produces a line of railroad castings. Metal is melted in four open-hearth furnaces. The McCormick works of the International Harvester Co. is one of the largest manufacturers of farming implement in the district. Both gray iron and malleable castings are made at this plant. A description of the tunnel-type annealing practice followed in this shop appeared in THE FOUNDRY for Jan. 15, 1924. The Hansell Elcock Co. manufactures machinery and jobbing castings from gray iron.

The W. A. Jones Foundry & Machine Co. maintains an interesting foundry in connection with its manufacturing establishment. The company makes gray iron machinery castings, and much of the work is made on molding machines. The National Malleable & Steel Castings Co. produces malleable and steel castings for automobile and railroad work.

Three interesting nonferrous plants are on the visitation program. The Sloan Valve Co. operates a compact foundry where an extensive line of plumbing supplies is produced. Special arrangement of the molding floor, the melting units and the methods of handling materials are of special interest. James B. Clow & Sons manufacture a line of plumbling supplies from brass. A description of the handling equipment installed in this plant appeared in the July 1, 1926 issue of THE FOUNDRY. The Imperial Brass Mfg. Co. operates a nonferrous foundry on the top floor of its manufacturing plant. Metal is melted in 30 coal and gas-fired furnaces and special equipment has been devised to handle the metal from the furnaces to the pouring floor. A number of plants which are not included in the group tours will receive visitors during the convention week. Information regarding these plants may be obtained at the booth of the plant visitation committee in the Edgewater Beach hotel. The following plants will be open for inspection:

Chicago Hardware Foundry Co., North Chicago, Ill.; Burnside Steel Foundry Co., 1300 East 92nd street; American Brake Shoe & Foundry Co., 332 South Michigan avenue; Leitelt Bros., 7725 South Chicago avenue; Chicago Steel Foundry, 37th and Kedzie; Griffin Wheel Co., 445 North Sacramento; Cribben & Sexton Co., West Chicago avenue and Sacramento; Kling Bros. Engineering Works, 1300 North Kostner; Western Electric Co., 22nd street and 48th avenue; Link-Belt Co., 300 West Pershing road; Faunt Bros. Brass

Foundry, 1555 Fulton street; Belle City Malleable Iron Co., Racine, Wis.; Ace Foundry Co., 4349 West Kinzie street; Ferguson & Lange Foundry Co., 1039 Willow street; Illinois Malleable Iron Co., 1801 Diversey Parkway; Electric Household Utilities Corp., Waukegan, Ill.; H. W. Caldwell & Sons, 2410 West 18th street; Magnus Metal Co., 2234 West 43rd street; Grabler Manufacturing Co., 4600 West Harrison street; Dole Valve Co., 1923 West Carroll avenue, O'Malley-Beare Valve Co., 255 East 95th street and the International Harvester Co., Deering Works.

Convention visitors also will be given an opportunity to visit the famous Ottawa district in the Illinois river territory. This district is noted for the production of silica molding sands, sandblast sands, refractory sands and materials and clays for molding sand bond. Foundrymen who make this trip will be shown the methods of mining, preparing and grading the various types of sands and refractory clays produced in the district. Arrangements for the trip are being made by the plant visitation committee, composed of members of the Chicago Foundrymen's club, upon the invitation of the Standard Silica Co., Illinois Clay Products Co., United States Silica Co., Chicago Retort & Firebrick Co., and the Ottawa Silica Co. Transportation to the Ottawa district will be provided Friday, by the committee.

The golf committee also has planned a golf tournament at the Illinois Golf club on Friday. Guests registering at convention headquarters as they arrive for the convention are urged to register also for golf if they desire to take part in any of the matches. Other links in Chicago and along the north and south shores also will be available to convention guests. Visitors are asked to bring their golf clubs. Noonday luncheon and dinner in the evening will be served at the Illinois Golf club on Friday, and suitable prizes will be awarded.

Plan Pleasures for Visitors

(Committee portraits on pages 36, 37, 38 and 39.)

General Committee

Wm. J. Nugent, Nugent Steel Casting Co., general chairman.
Frank D. Chase, Frank D. Chase, Inc., vice chairman.
S. T. Johnston, S. Obermayer Co.
H. S. Simpson, National Engineering Co.
A. E. McClintock, National Founders' Assn.
T. S. Hammond, Whiting Corp., Harvey, Ill.
C. B. Carter, Alloys Foundry Co.
David Evans, Chicago Steel Foundry Co.
R. D. Phelps, Francis & Nygren Foundry Co.
Geo. A. Rolinson, American Brake Shoe & Foundry Co.
C. P. Wright, American Brake Shoe & Foundry Co.
J. A. Byers, James B. Clow & Sons.
C. C. Kawin, Charles C. Kawin Co.
John S. Sammons, Beardsley & Piper Co.

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Frank Caldwell, Link-Belt Co., vice chairman.
E. O. Beardsley, Beardsley & Piper Co.
Kent S. Clow, James B. Clow & Sons.
I. Kaden, H. Kramer & Co.
Theo. Kauffman, S. Obermayer Co.
Chas. B. Magrath, Greenlee Foundry Co.
Geo. L. Pollock, Burnside Steel Co.
S. B. White, International Harvester Co.

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C. D. Hollins, National Engineering Co., vice chairman.
George Birkenstein, S. Birkenstein & Sons.
Gust Erlandson, Kedzie Foundry Co.
C. H. Estes, American Manganese Steel Co.
James E. Evans, S. Obermayer Co.
Wm. H. Griner, Chas. C. Kawin Co.
C. P. Guion, W. W. Sly Mfg. Co.
J. J. Hartley, Link-Belt Co.
M. S. Lawrence, Whiting Corp., Harvey, Ill.
W. MacFadden, Chicago Crucible Co.
H. B. Reed, Green Engineering Co., East Chicago, Ind.
J. Rowbottom, Diversey Foundry Co.
A. A. Wickland, A. A. Wickland & Co., Inc.
J. D. Wisemen, Buda Co., Harvey, Ill.

Ladies' Entertainment Committee

David Evans, Chicago Steel Foundry Co., chairman.
Mrs. Warren G. Jones, vice chairman.
W. H. Kleppinger, Calumet Foundry & Machine Co., East Chicago, Ind.
Howard J. O'Neil, Western Foundry Co.

SUB-COMMITTEES

REGISTRATION—Mrs. W. J. Nugent, chairman.
RECEPTION—Mrs. C. E. Hoyt, chairman.
LUNCHEON AND BRIDGE—Mrs. Howard J. O'Neil, chairman.
GOLF—Mrs. C. C. Kawin, chairman.

Reception Committee

R. D. Phelps, Francis & Nygren Foundry Co., chairman.
Volney Foster, U. S. Silica Co., vice chairman.
H. V. Adams, Foundry Supplies Mfg. Co.
D. G. Anderson, Western Electric Co.
Uncle Billy Chambers, Material Service Corp.
Donald L. Colwell, Stewart Mfg. Corp.
E. V. Crouse, International Harvester Co.
J. L. Cummings, S. Obermayer Co.
D. A. Flynn, Peoples Gas Light & Coke Co.
E. E. Griest, Chicago Railway Equipment Co.
Vitus J. Houha, American Building Foundry Co.
H. O. Lange, Ferguson & Lange Foundry Co.
G. A. T. Long, Pickands, Brown & Co.
Randolph McCandlish, Standard Silica Co.
H. E. Meng, W. D. Allen Mfg. Co.
W. J. Michael, Tarrant Foundry Co.
Fred Moerl, Pullman Car & Mfg. Co.
R. H. Moorish, Home Stove & Foundry Co.
J. C. Nellegar, H. W. Caldwell & Son Co.
F. K. North, Illinois Malleable Iron Co.
O. J. Peterson, S. Obermayer Co.
R. B. Pogue, American Brake Shoe & Foundry Co.
Wm. Pyott, Pyott Foundry Co.
Mr. Shaw, Canedy-Otto Mfg. Co.
Eugene W. Smith, Crane Co.
H. M. Thompson, H. M. Thompson Co., Inc.
H. W. Ufer, Griffin Wheel Co.
R. I. Wells, Chicago Foundry Co.

Plant Visitation Committee

G. A. Rolinson, American Brake Shoe & Foundry Co., chairman.
H. S. Vrooman, H. S. Vrooman Co., vice chairman.
G. P. Fisher, Whiting Corp., Harvey, Ill.
R. A. Fiske, *Iron Age*.
R. W. Freeland, Hubbard Steel Foundry Co., East Chicago, Ind.
J. H. Hopp, Hopp-Patterson Co.
Al. V. Magnuson, Champion Foundry & Machine Co.
John Marr, Nugent Steel Castings Co.
R. T. Martin, International Harvester Co.
Gottfrid Olson, Illinois Malleable Iron Co.
Eugene W. Smith, Crane Co.

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A. J. Johnston, Hickman, Williams & Co., vice chairman.
Geo. S. Casgrain, Griffin Wheel Co.
C. P. Dickerman, American Car & Foundry Co.
D. J. Kelday, International Harvester Co.
Edward Sherwin, Chicago Hardware Foundry Co., North Chicago.
Walter Underwood, St. Louis Coke & Iron Corp.

Publicity Committee

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Russel T. Gray, Russel T. Gray Inc., vice chairman
A. DeYoung, Whiting Corp., Harvey, Ill.
R. A. Fiske, *Iron Age*.
F. B. Pletcher, THE FOUNDRY.

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David Evans, Chicago Steel Foundry Co., vice chairman.
Warren G. Jones, W. A. Jones Foundry & Machine Co., vice chairman.
Claud Faunt, Faunt Bros. Brass Foundry.
Russell T. Gray, Russel T. Gray, Inc.
J. M. Taylor, National Founders Assn.
F. J. Sherwin, Chicago Hardware Foundry Co., North Chicago.

Hotel Committee

John S. Sammons, Beardsley & Piper Co., chairman.
B. B. Wilson, Edgewater Beach Hotel, vice chairman.
F. J. Riley, Liquid Carbonic Co.

The Steamship ALABAMA, *Shown in the Foreground, Will Leave the Municipal Pier Thursday Afternoon for the Boat Ride*

Chicago Offers Hospitality

CHICAGO foundrymen are planning to entertain royally the leaders of the foundry industry who will attend the annual convention of the American Foundrymen's association at the Edgewater Beach hotel, June 6 to 10. Committees have been at work for months arranging a program of entertainment which will occupy practically all of the time not alloted to the business of the convention. The extensive program of plant visitation, which has been arranged by a committee from the Chicago Foundrymen's club, is described fully elsewhere in this section. A special program has been prepared for the visiting ladies which will permit them to see many of the points of interest in Chicago and enjoy automobile rides on the boulevards which interconnect many of the famous parks maintained by the city of Chicago.

On Monday, while the men are being conducted through several of the leading foundries of the city, the ladies will be occupied with registration, a reception and informal entertainment. At 4 p. m. a reception will be given by President and Mrs. Stuart Wells Utley, assisted by A. F. A. directors and wives, in the east and west lounges of the Edgewater Beach hotel. No special entertainment is planned for Monday evening. Registration and the various activities of the week will center at the Edgewater Beach hotel, which may be reached from the Loop district on the motor bus lines or on the elevated railroad.

An automobile ride through the beautiful north shore section will feature the program for the ladies on Tuesday morning. The trip will include the exclusive residential section of Chicago, Evanston with Northwestern university and several other suburbs which follow the shore of Lake Michigan on the north. Tuesday afternoon will be devoted to putting contests on the greens of the Edgewater Beach hotel. Prizes will be offered for the best foursome. A bridge party will be staged for the ladies who do not wish to enter the contest and suitable prizes will be given for each table. The ladies are requested to register early for these events.

A dinner will be given Tuesday evening to the members and ladies attending the convention. This dinner and entertainment program will be staged at the Rainbow Gardens, a world famous restaurant, amusement palace and the home of the radio broadcasting station WQJ. A dinner will be served on the lower floor, the greater portion of which has been reserved for the evening. Dancing will be in order during the dinner hour to music furnished by Katz and his Kittens, a well known Chicago orchestra. Throughout the evening guests will be entertained by the Rainbow Gardens cast of forty people.

On Wednesday morning at 10:30, the ladies will start from the Edgewater Beach hotel for an automobile tour which will include Michigan avenue from the hotel to the south side of the city. This route extends over the recently completed outer drive at Lincoln park and through the beautiful Jackson park section on the south, with a stop at the Field museum. After a luncheon at the South Shore Country club, the guests will visit the University of Chicago where they will inspect the Ida Noyes hall and the chemistry division. The party will return to the Edgewater Beach hotel between 4:30 and 5 p. m.

The annual banquet of the American Foundrymen's association will be held Wednesday evening, June 8, at the Edgewater Beach hotel. Further plans for this association activity will be announced later. Following the banquet the Chicago committee will give a reception and dance.

Since many of the visiting ladies probably will wish to take advantage of the exceptional shopping facilities offered by Chicago's mercantile establishments, no entertainment has been planned for Thursday morning.

The steamship ALABAMA, the flagship of the Goodrich Transportation Co., Chicago, has been chartered for a boat ride on Lake Michigan Thursday afternoon. The boat will leave Municipal pier at 2 o'clock and will give the convention visitors an opportunity of seeing the beautiful Chicago lake front from Lake Michigan. Arrangements have been made for dancing on the boat trip with music furnished by the Edgewater Beach hotel orchestra of seventeen pieces. This orchestra is well known to radio listeners since it broadcasts nightly over station WEBH, which is located at the Edgewater Beach hotel. Other entertainment will be provided for the trip.

Members and guests of the American Foundrymen's association will be delighted with the facilities offered by the Edgewater Beach hotel. The hostelry has all of the advantages of a resort hotel and at the same time is located conveniently to the activities of the great city and industrial center. The water front, private bathing beach, promenades, lawns, tennis courts, miniature golf course and putting greens provided at the hotel offer advantages for pleasure which are not being overlooked by the entertainment committees. Accommodations are equally good for committee gatherings and meetings.

S. T. JOHNSTON

WM. J. NUGENT

FRANK D. CHASE

H. S. SIMPSON

G. A. ROLINSON

T. S. HAMMOND

MRS. W. G. JONES

C. B. CARTER

JOHN S. SAMMONS

R. D. PHELPS

DAVID EVANS

C. P. WRIGHT

C. C. KAWIN

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FRANK CALDWELL

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GEO. L. POLLOCK

MRS. C. C. KAWIN

GEO. A. T. LONG

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EUGENE W. SMITH

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F. J. SHERWIN

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AL. V. MAGNUSON

J. ROWBOTTOM
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J. L. CUMMINGS
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C. H. ESTES
D. A. FLYNN
J. D. WISEMEN
HOWARD J. O'NEIL
R. H. MORRISH
E. E. GRIEST
GOTTFRID OLSON
R. W. FREELAND
H. O. LANGE

Marquette and a small party spent the winter of 1674 near Chicago

Pioneers Built *Groundwork* For City's Growth

HOW did Chicago rise to the present commercial heights which have earned the appellation, rightly applied, of the industrial heart of the nation? What has given this city its pre-eminence and why was that particular area around the lower reaches of Lake Michigan chosen as a site and developed into the second largest metropolis of the nation?

The answers to these questions are written in the hardihood of early French explorers, the bravery of American pioneers, the strength and optimism of later settlers and the faith and ability of this generation and the one immediately preceding. Marquette is a name hallowed in the history of Chicago. The spirit of adventure and religious zeal which actuated that brave young priest, led him forth in 1673 accompanied by Louis Joliet, a fur trader, to discover a passage to the South sea. These two adventurers, the one an idealist but with a thoroughly practical mind and the other a pioneer of commerce, were accompanied in their journey by five other white men. They thrust forth from Mackinaw into the great unknown area of the western lakes, apprehensive, but undaunted by the wild tribes of Indians that infested the prairies and inland waterways of the country.

Travel by land was exceedingly difficult and fraught with danger in those days. The streams and lakes offered the easiest transportation. Accordingly, the little party crossed Green bay and by portage and short canoe journey, passed through Lake Winnebago, ascending the Fox river and then across to the headwaters of the Wisconsin until they reached the broad expanse of the Father of Waters. Thence the little party swept down the Mississippi, past the mouth of the Arkansas, where they were confronted by such numbers of hostile Indians that they turned back rather than risk capture with the loss of the knowledge they had thus far accumulated. Returning northward and after battling with the descending current of the Mississippi for many weeks, the party sought the easier waters of the Illinois to lighten their labors, and thence by way of the Kaskaskia and the Desplaines river they reached Winnebago at the end of September, 1673, after having paddled more than 2700 miles since early spring. At that time Marquette probably passed through the territory now covered by the city of Chicago. Later he returned to the vicinity and illness forced him to spend practically the entire winter of 1674 in the marshy region near the point where the Chicago river approaches the bank of Lake Michigan.

Later La Salle in the course of his explorations passed and repassed the present site of Chicago. These early French explorers, missionaries and trappers followed the age-old trail of the Indians, who found at Chikagwa, as it was known to them, a natural channel of trade and travel. The portage was short from the marshy banks of the lake to the river which found its way toward the Mississippi. Trapping and hunting parties, tribes on the restless march of the nomad in search of new homeland, warriors sweeping downward to the lush lands of the peace loving Illini, found at this point a gateway from the Great Lakes basin to the great central valley of the Mississippi.

When the English wrested the northern and western territory from the French, they in turn found the gateway convenient for their westerward march, but it was not until the colonies had cast off allegiance to the old country that the value of this point as an outpost of strategic military value became apparent. Colonel Hamtramck, stationed at Detroit, sent a party headed by Capt. John Whistler, an ancestor of the famous artist, to build a military post. They built a log stockade, with blockhouses at opposite corners, the Fort Dearborn, familiar to many through the use of drawings, photographs and etch-

ings on the stationery of Chicago institutions. Two years were required to build this post, which became the nucleus of a small band of settlers, and the last link with eastern markets maintained by the trappers and traders of the period.

Dark tragedy hung over this first venture of organized civilization into the vicinity of Chicago. In 1812, unfriendly tribes of Indians invested the fort. At this time the war was in progress with England and that country had courted the favor of these savages, while the American forces asked merely the maintenance of neutrality. With the disaster which followed an attempt of the colonial troops to conquer that portion of Canada near Detroit, the Indians felt that they were sure of choosing the winning side by making active war on the Americans. Ordered to surrender the fort and under a promise of safe conduct, the small party of settlers, with their women and children escorted by a handful of soldiers sallied forth and practically every soul was massacred near the present location of Michigan boulevard. The fort was destroyed and it was not until 1815 that it was rebuilt and the continuity of civilized community life was established at Chicago.

It was evident that this meeting place between the unparallel waterways could not fail to be a place for distributing commodities. To the north awaiting only the ax of the forester were the lumber regions of Michigan and Wisconsin. South, West and East stretched the rolling, fertile prairies, rich and virgin, awaiting the plow of the westward pushing agriculturist. Coal underlying the fields of Illinois, Indiana and Pennsylvania, when brought to the surface, converged toward this commercial center to radiate outward over the western and northern states. The red iron ore and copper-bearing regions of Lake Superior sent their cargoes to be piled upon the docks of the city, the meeting place of grain, lumber, fuel and metal.

Is it not natural that Chicago should become a city of commerce and industry, even if the steam railroads had not come to assist the great waterways in making this the halfway point in stupendous transcontinental traffic?

Although a few saw these possibilities and appreciated the future in store for Chicago, there was no rush to the spot. In 1823, the total assessed valuation of the property of the town was less than $3000, while today it is more than a billion dollars and the value of the annual production of manufactured products is more than six billions. The town was incorporated in 1833 by the vote of twenty-eight electors. Today the population is in excess of three millions of people.

Chicago did not achieve its present pre-eminence without struggle and adversity. Fire, flood, panic and pestilence were encountered and overcome in turn by the determination and courage of its inhabitants. A real estate boom of the early days, when the town was surpassed in total of inhabitants by a number of other Illinois communities, was brought to a close by the panic of 1837. Later a mysterious disease, like Asiatic cholera, stopped work upon the Illinois and Michigan canal. Floods swept away the city's shipping and the culmination of calamity was reached in the "great Chicago fire" of 1871 when 1470 acres of buildings were utterly consumed and more than a hundred thousand people were left homeless and in many instances destitute.

Under each of these blows, the city suffered but recovered and undertook the task of building to greater heights. When the World's Fair was undertaken in 1893, this spirit carried through an exposition which eclipsed all previous effort in this direction. In this as in every other instance the challenge to accomplishment met with ready response.

Starting with the needs of agriculture and transportation as a basis, the city has developed industry unsurpassed in variety and extent. To meet the requirements of her manufacturing establishments, the foundry industry of the city has kept step with general industrial development. Situated in the center of a great iron and steel district, Chicago has built a phenomenal foundry industry. In addition to meeting these calls of her own manufacturers, the city ships castings from her gray iron, malleable, steel and nonferrous foundries throughout the states of Illinois, Indiana, Iowa, Wisconsin, Ohio and Michigan. Agricultural implements and farm machinery form the predominant lines that consume these castings in manufacture. Equipment of this class, made in and about Chicago is shipped throughout the world. The period from 1914 to 1923, embracing the war years, saw a growth of 178 per cent in the value of foundry products made in the Chicago district. These products were valued at $65,000,000 in 1914 and increased to more than $181,000,000 in 1923 when figures last were compiled.

Pere Jacques Marquette

IN THE lobby of the Marquette building, location of the executive offices of the American Foundrymen's association will be found a number of bronze castings depicting events and personages in the history of Chicago. The one at the head of this article was made by the sculptor Herman A. McNeil, while the portrait plaques are the conception of Edward Kemeys. These interesting castings were made in the old Winslow foundry which was acquired by the Grabler Mfg. Co. Two of the molders who made the work were Jules Berchem and Jean Titrent. The former now owns the American Art Bronze Foundry, Chicago. The photographs reproduced are offered through the courtesy of the Chicago Historical society.

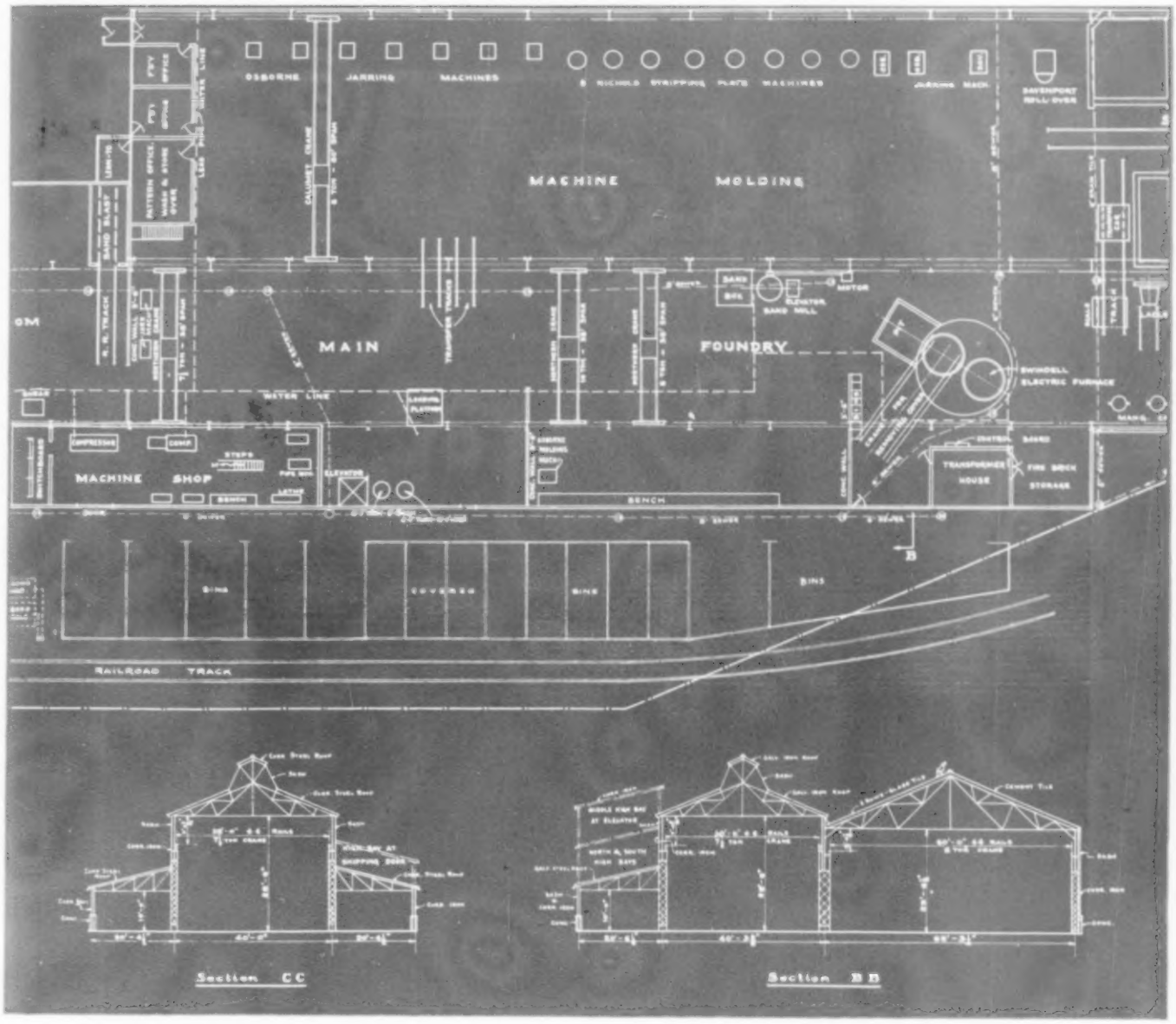
Sieur Louis Joliet

Swindell Multiple Type Electric Melting Furnace in Action

One Furnace ready for melting and the other furnace pouring the finished steel at the plant of the Burnside Steel Foundry Company, Chicago, Ill. Electrically driven turntable.

Foundrymen at the Chicago Convention should arrange to visit this Swindell installation.

WM. SWINDELL & BROS.



Part Layout of the

Burnside Steel Foundry Company, Chicago, Ill.

This foundry using the Swindell Multiple Electric Melting Furnace specializes in high quality small steel castings and is especially laid out for production, quality of steel and accuracy of castings to pattern.

PITTSBURGH, PENNA.

The ROYER
SAND SEPARATOR AND BLENDER
ROYER PRODUCTS
RECOMMEND THEMSELVES

Prepares Sand Better and Cheaper

The Royer Sand Separator and Blender, although a distinct and radical departure from the usual methods of foundry sand preparation, is not an expe iment but a thoroughly proven product. This is testified to by the large number of Royer installations in all parts of the United States, Canada and abroad. Many of these are in the Chicago district and are available for inspection by visiting foundrymen at the Chicago Convention.

The photograph on the opposite page shows a Royer Sand Separator and Blender in the plant of The Hubbard Steel Foundry Company, East Chicago, Ind. This is a model "D" machine so arranged that the sand may be fed into the machine with a bucket operated by the crane. The capacity of model "D" is 1000 lbs. of sand per minute.

We also manufacture a smaller machine, model "B", with a 400 lbs. per minute capacity and a larger, model "C", the capacity of which is 700 lbs. per minute.

Royer Foundry & Machine Co. Kingston Station **Wilkes-Barre, Pa.**

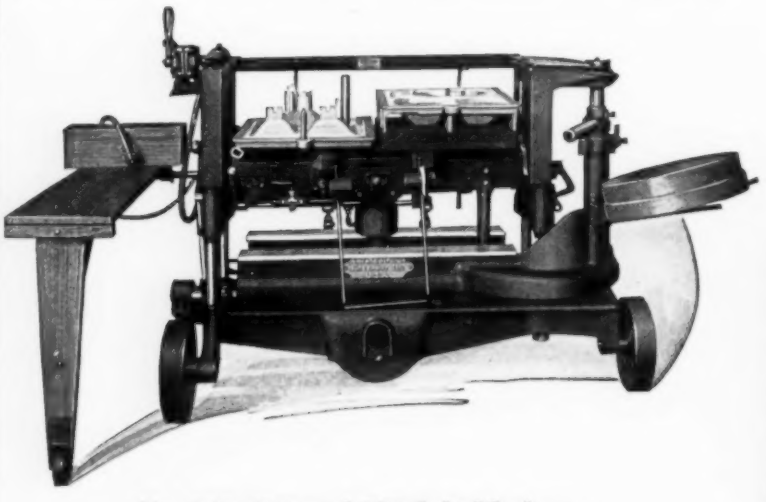
Representatives

Hill & Griffiths Co., Birmingham, Alabama
Alexander Haigh, Boston, Massachusetts
Page & Ludwick, Chicago, Illinois
William Mayor, 523 Penton Bldg., Cleveland, Ohio
Fenton Foundry Supply Co., Dayton, Ohio
Snyder Foundry Supply Co., Los Angeles, California
David D. Baxter, Rochester, New York
Independent Foundry Supply Co., St. Louis, Missouri
Pacific Graphite Works, Oakland, California

Manufactured in Great Britain by Pneulec Machine Co., Ltd., Smethwick, near Birmingham
Manufactured in France by Fenwick Freres, 8 Rue de Rocroy, Paris

ROYER PRODUCTS RECOMMEND THEMSELVES

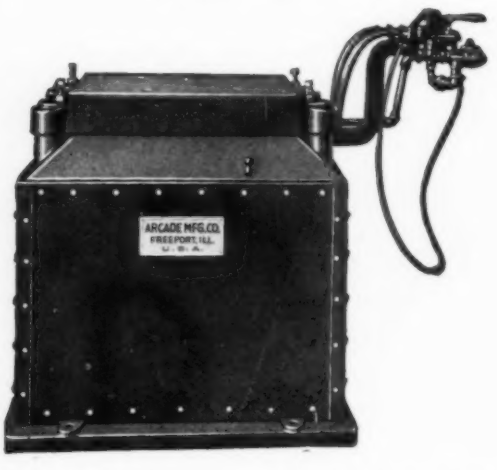
ARCADE MOLDING MACHINES AND FOUNDRY EQUIPMENT



No. 110, 220 and 330 Jolt Moderns

Jolt Rollover Squeeze Pattern Draw. Many new improvements. Ask for bulletin No. 31-A.

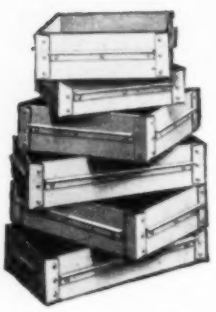
No. 610 Duplex Jolt Stripper
Perfect draw.



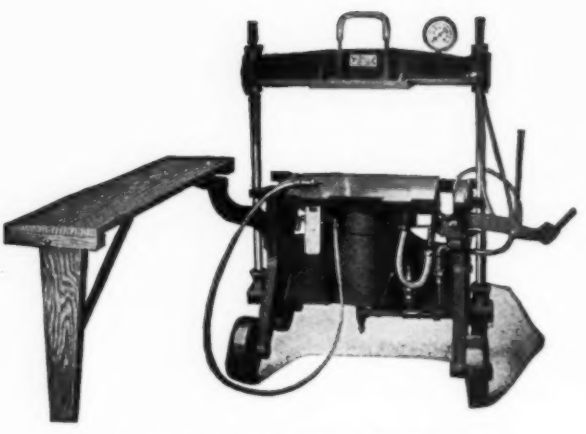
This is the most perfectly protected Jolt Stripper made. No sand can filter in. Ask for bulletin No. 31-E.

Brillion 20th Century Pouring Devices and Cranes Save and Make Money

Cherry Flasks MILLED PINS AND EARS



Steel Jackets No. 10 Gauge WELL BRACED



No. 81 and No. 91 Jolt Squeezer

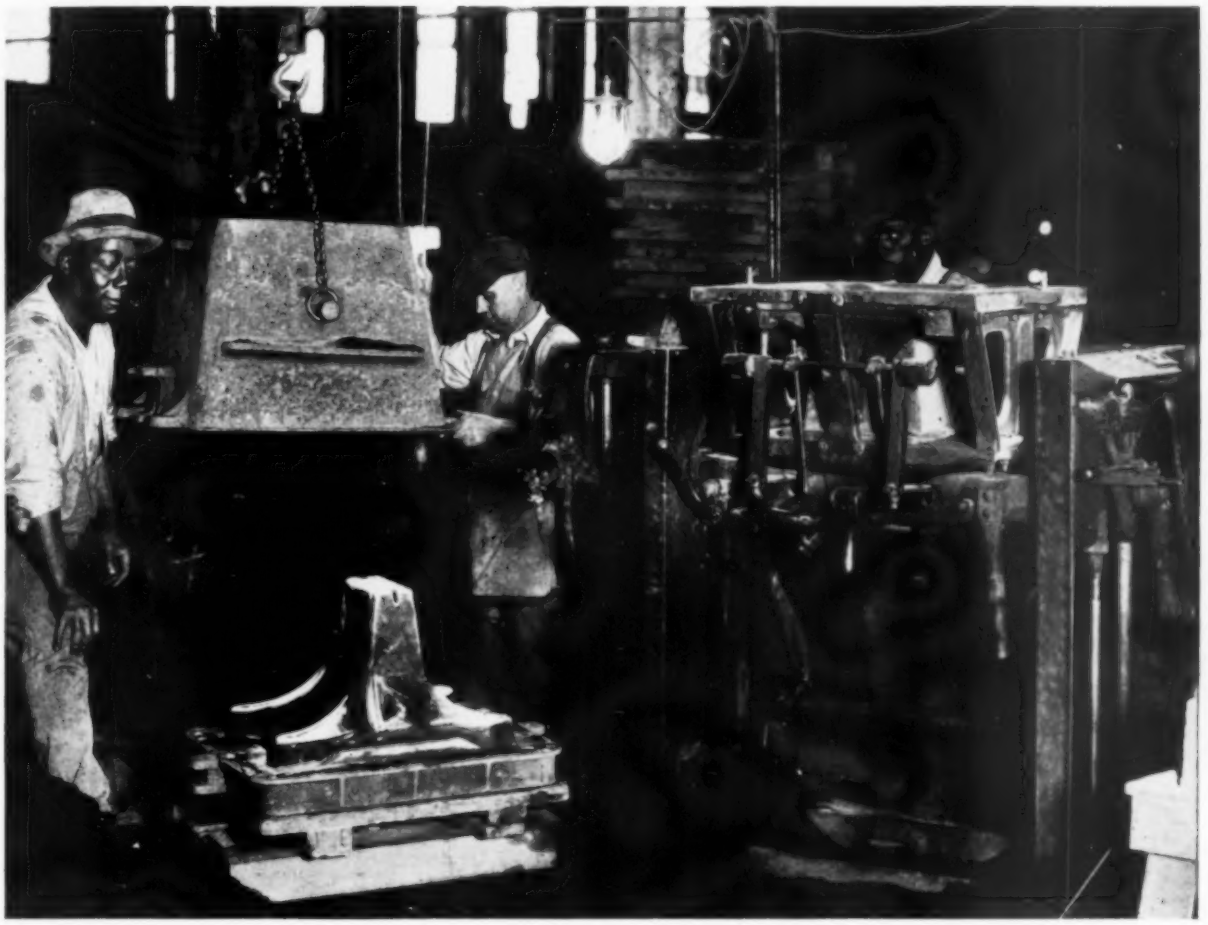
Distance between uprights	32" and 36"
Diameter Jolt cylinder	3" and 4"
Diameter Squeeze cylinder	8½" and 10"

Arcade Manufacturing Company

Freeport, Illinois, U. S. A.

ARCADE MOLDING MACHINES AND FOUNDRY EQUIPMENT

A Man's Size Job



Drag Machine has 14 inches draw and Duplex Jolt Stripper for cope 19 inches draw.

This equipment is in the Chicago district. See it while at the Convention. Ask us where.

Arcade Manufacturing Company

Freeport, Illinois, U. S. A.

Hercules Limed Wood Rosin

for

Dry Core Binders

Hercules Limed Wood Rosin is being used with pronounced success as a dry binder. It has been treated to raise the melting point, so that the rosin pulverizes readily without gumming the machinery. This also lessens the tendency of the cores to stick to the core boxes.

Hercules F Wood Rosin No. 11— For Use in Core Oil Manufacture

This rosin was developed for the core oil manufacturer. Since its introduction it has enjoyed a steadily increasing use.

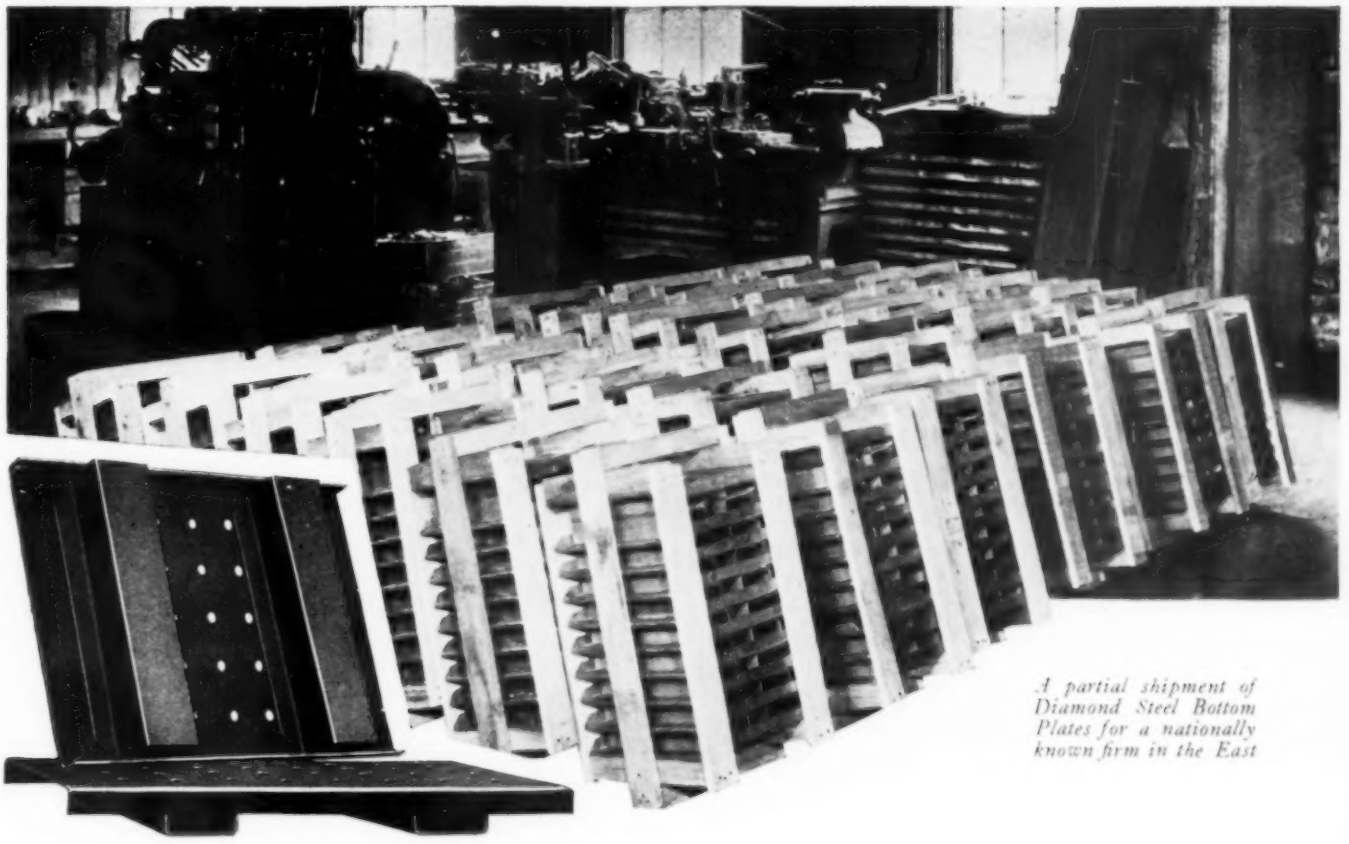
Write for specifications and prices

HERCULES POWDER COMPANY
(INCORPORATED)

935 Market Street, Wilmington, Delaware

Sales Offices

Birmingham, Ala.
Chicago, Ill.
Chattanooga, Tenn.
Duluth, Minn.
Joplin, Mo.
New York, N. Y.
Pittsburgh, Pa.
Salt Lake City, Utah
San Francisco, Calif.
St. Louis, Mo.



A partial shipment of Diamond Steel Bottom Plates for a nationally known firm in the East

"Diamond" Steel Bottom Plates are Permanent Equipment

Big savings are now being effected by foundrymen who have realized the folly of burning up good money by using wooden bottom boards.

The new Diamond Steel Bottom Plates are practically indestructible. They're *permanent equipment*—can't burn, warp or break. Made of rust-resisting steel and built to stand the roughest usage. Made in various styles and many sizes for every use.

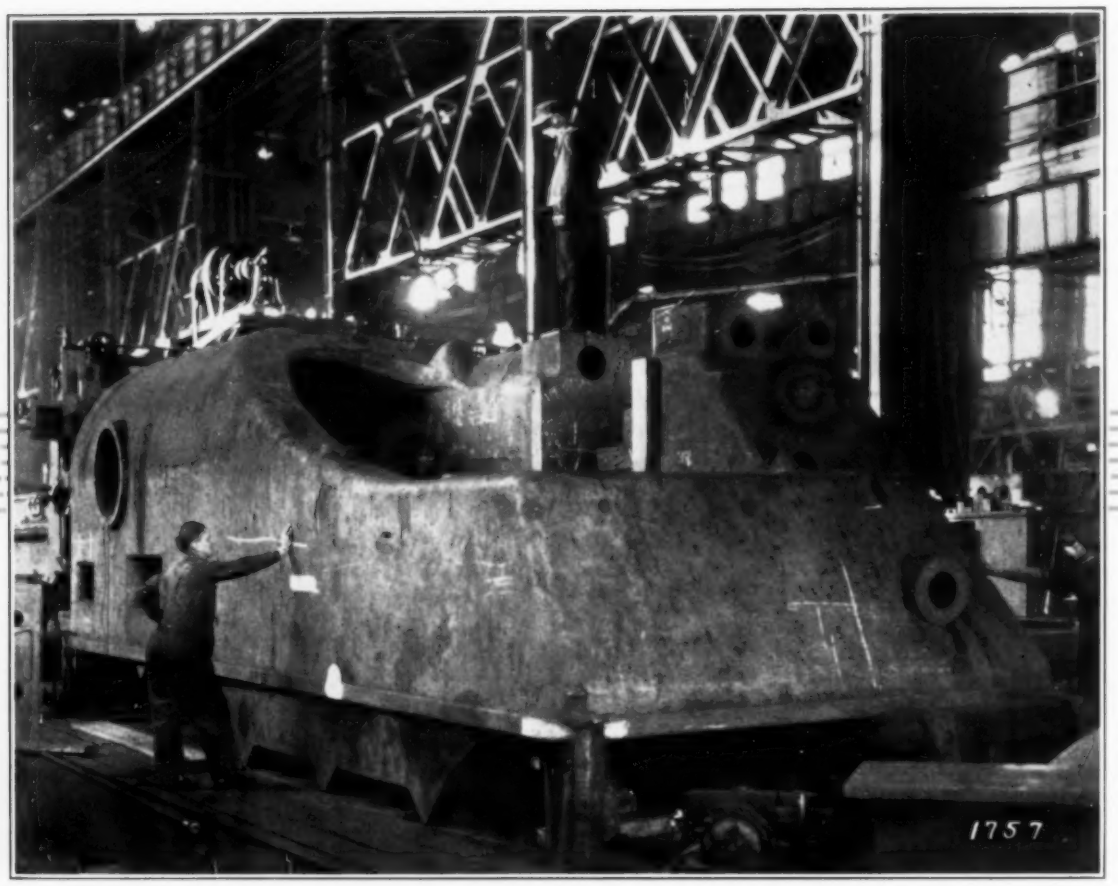
Other Diamond Products:

- Diamond Pattern Makers Clamps
- Diamond Wood Core Boxes
- Diamond Pinch Dogs
- Diamond Shake Out Tongs
- Diamond Flask Clamps
- Diamond Brass Dowel Pins
- Diamond Core Plates
- Diamond Master Flasks
- Diamond Steel Bands
- Diamond Jackets
- Master Flask Fittings
- Diamond Rapping Plates
- Diamond Bottom Plates
- Diamond Hardwood Wedges

Diamond Clamp & Flask Co.

38-40 N. 14th Street **RICHMOND, INDIANA**

Doing Big Things In a Big Way



The above casting is one of six bases each weighing 108 tons when finished.

It took six weeks to mold each base and three 50-ton cranes were used to lift each one out of the pit.

And then it took two railroad cars to ship each base.

Blacking and Core Wash, of course
by McCormick of Pittsburgh

See Us in Chicago

June 6th to 9th
at the
1927 Annual
Convention
of the
American
Foundrymens
Association

AA
Flask

The Sterling Wheelbarrow Company will occupy a room at the Edgewater Beach Hotel, the Convention Headquarters, where you will be welcomed by representatives, Mr. H. H. Baker and Mr. R. T. Jordan, who will gladly discuss any of your problems with you.

Sterling

Labor saving specialties cover items of which every foundry has daily need—

Steel Flasks
Barrows
Flask Pins—Wood Wedges
Core Barrows
Shop Boxes—Skim Gates
Foundry Trucks
Slag Buggies—Snap Flasks
Charging Cars or
Flask Bands

Foundry
Barrow
No. 11

Sterling Warehouses:—
Chicago—New York—Detroit
Cleveland—St. Louis—Philadelphia

STERLING WHEELBARROW COMPANY

STERLING ON A WHEELBARROW MEANS MORE THAN STERLING ON SILVER

Milwaukee Wisconsin

MANUFACTURED FOR THE EUROPEAN MARKETS BY—
STERLING FOUNDRY SPECIALTIES LTD. STERLING WORKS, BEDFORD, ENGLAND

DON'T ACCEPT A SUBSTITUTE!

Glutrin and Goulac

are used in many of the Foundries in Chicago to be visited during Convention Week, June 6th to 10th.

We invite your inspection of the Cores and Castings produced.

Robeson Process Company

American Gum Products Company

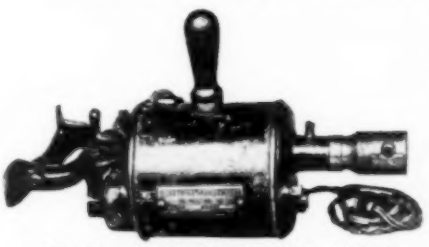
General Offices:

200 Fifth Avenue, NEW YORK CITY

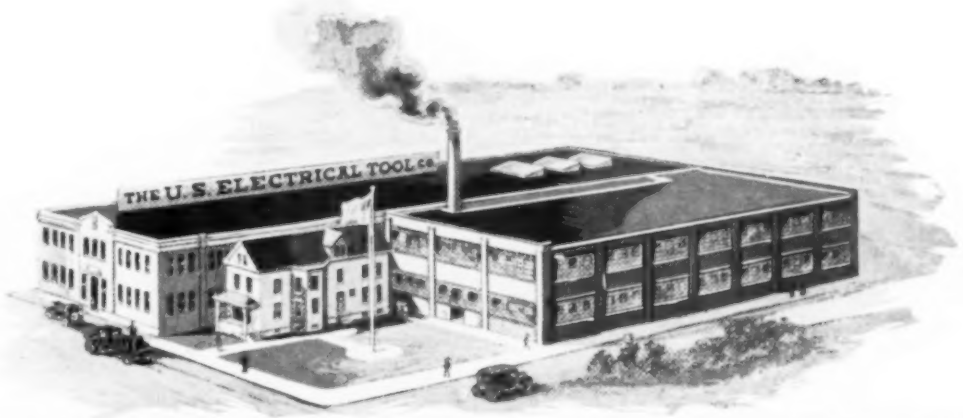
THE UNITED STATES ELECTRICAL TOOL CO.
CINCINNATI, OHIO, U. S. A.

U. S. Heavy Duty 4-Ball-Bearing Grinder for A. C. or D. C.

IN a stable at Dayton, Kentucky, in 1897, the first electric drill and grinder were introduced to the world. They were conceived in the brain of John A. Smith, founder of The United States Electrical Tool Company, and its President since the beginning. Today, portable electric tools and electric grinders are used in production and maintenance work by over 90 percent of all industry. Practically all of the improvements in design and construction which have made possible this progress in time and labor saving, have been introduced by U. S. Tools. And our seniority in the field carries with it the responsibility of *keeping* U. S. Tools in the lead—in other words, keeping them *better*.



The first electric drill, a U. S. ¼-inch. The handle was made of wood to protect against shocks. The switch was like today's street car controller, having 6 speeds. The drill weighed 23½ pounds! The latest model weighs only 5¾ pounds.



THE UNITED STATES ELECTRICAL TOOL CO.

Oldest Builders of Electric Drills and Grinders in the World

2486 West Sixth St., CINCINNATI, OHIO, U. S. A.

Export Sales Representatives—WESTINGHOUSE ELECTRIC INTERNATIONAL CO.—150 Broadway, New York

Federal Products are guaranteed to give satisfaction, are used extensively in the plants you will visit in Chicago, and are produced at our Chicago Factory.

Federal Bond Parting Compound

Guaranteed To part *all* grades of sand; to effect a perfect separation, regardless of shape —to stand swabbing; to be air-floated— light in weight—bulky; economical to use—and non-injurious to the health of the operator.

The Federal Foundry Supply Company
Factories; Cleveland, Chicago, Charleroi.
Warehouses; Detroit, Milwaukee.

FEDERAL BOND PARTING COMPOUND makes it easy to produce perfect partings at a minimum expense. No matter how irregular or complicated the shape of the pattern, FEDERAL BOND PARTING COMPOUND insures perfect separation. Replaces Lycopodium at a very small fraction of the cost, and works equally well in all grades of sand with or without heavy mixtures of flour, molasses water or other binders.

This compound can be used with all regular facings, can be swabbed and slicked perfectly and will not cut, wash or burn. Air-floated and of such super-fineness that it easily sifts through the shake bag without clogging or waste. It will not injure the health of the operator. Costs only 4 cents a pound in less car lots with freight allowed to your station.

OUR TRIAL OFFER

We will ship a 400 pound barrel (or more) of FEDERAL BOND PARTING COMPOUND for you to put to the most rigid test. Use it in your finest work. Consider the small cost of FEDERAL BOND PARTING as compared with Lycopodium; observe the high quality of work. If you are not fully convinced it is absolutely essential to your work, return what remains. We will credit you with the unused portion and pay the freight charges. Act on this offer now.

MAIL THE COUPON

THE FEDERAL FOUNDRY SUPPLY CO.,
CLEVELAND, OHIO

Gentlemen:—You may ship us one 400-pound barrel of Federal Bond Parting Compound, with the understanding that if after a fair trial, we do not find it has done all you claim, we are to have the privilege of returning it at your expense; you to give full credit for unused portion so returned.

Name .....

Address .....

City ..... State .....

FEDERAL FOUNDRY SUPPLY CO.

CLEVELAND, OHIO

Factories; Cleveland, Chicago, Charleroi
Warehouses; Detroit—Milwaukee

ALBANY SAND

CAREFULLY GRADED

Dependable!

LABORATORY TESTED

A reputation can never be built on occasional quality. One standard—and a high one—*All The Time*—is the one foundation for a reputation.

Albany Sand & Supply Co.

ALBANY, N. Y.

No More Compounding of Bonds —in your molding sand

Here is a product revolutionizing steel molding by replacing all fire clay and all farinaceous or organic vegetable binders, thereby producing molds, which when poured are free from gas or smoke except where cores are used.

Equally as effective in savings on iron molding.

Used in green or dry sand-molding, is the ONLY bond required.

Reduces sand consumption and cleaning cost, increases percentage of perfect castings and materially reduces total costs. It is called

WILKINITE

NATURE'S 100% MINERAL BOND

Fusion Point 2326° F

WILKINITE used as the bond in natural or Synthetic Sand produces such porosity that oxidation is very low and permits of continuous reuse of the sand.

Over 99% will remain in suspension in water.

WILKINITE is not an experiment but a proven successful product resulting from severa years of practical tests and use. Many representative iron and steel foundries are car-load buyers.

Guaranteed permanent, uniform, unlimited supply. Mined underground like coal, the heart of the vein only. Continuous year-round operations—not in any way dependent on weather conditions. NO FLUCTUATIONS IN PRICE.

The only equipment necessary to secure 100% satisfactory results is a sand-mixer of the Simpson type.

Samples for laboratory or practical tests will be furnished without charge, also any information relative to its practical application.

Specify WILKINITE on your orders, there is nothing else just as good. Insist on this tried and proven product.

OWYHEE CHEMICAL PRODUCTS COMPANY

Exclusive Producers

Plants: Medicine Bow and Cheyenne, Wyo.

OFFICE and WAREHOUSE, Chicago, Ill.

HARRY HAZE, INC.,
General
Sales Agent,
300 W. Adams Bldg.,
Chicago, Ill.

Without obligation ship us working Sample WILKINITE.

We operate .....muller.

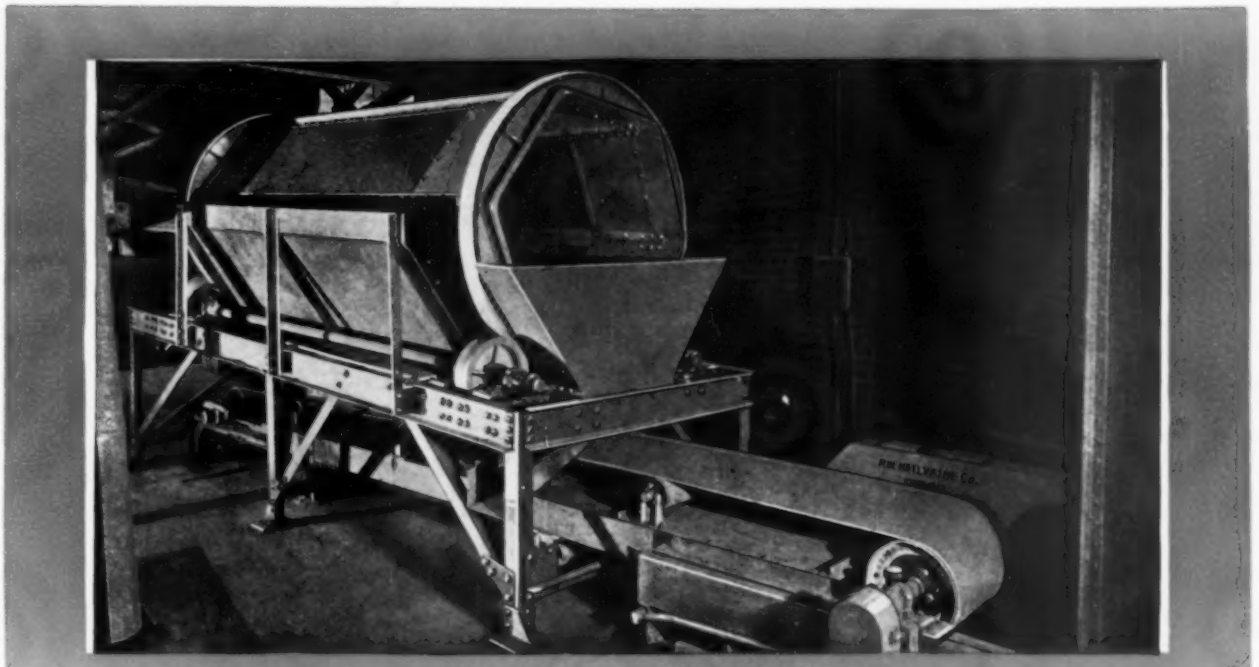
Firm .....

City .....

.....
Purch. Agt., Supt. or Foreman.

HARRY HAZE, INC.
General Sales Agent
300 W. Adams Bldg.
Telephone—Central 7743
Chicago, Ill.

J. J. MAYOU FOUNDRY SUPPLY COMPANY
Special Sales Agents for Foundry Trade in Central States.
Telephone—Harrison 3064
Chicago, Ill.



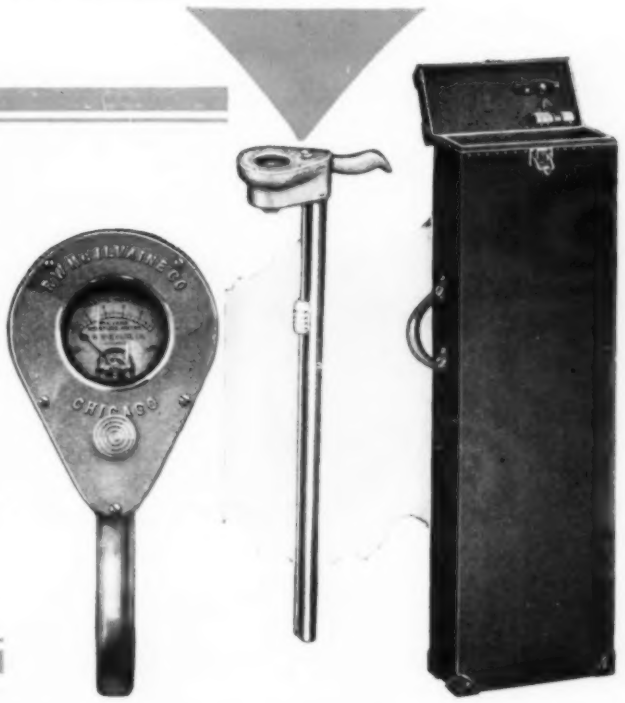
Hexagonal Screening and Separating Unit with enclosed gear drive. This unit receives sand from shakeout conveyor and delivers it to the conditioner—Maytag Co., Newton, Iowa.

McIlvaine Sand Handling and Conditioning Equipment is used in many of the representative production foundries. It is daily proving our contention that "Good sand handling systems pay big dividends."

Our engineers are trained foundrymen. Their recommendation of McIlvaine equipment will reflect the wealth of practical foundry experience that is behind them.

Years ago we learned—from personal experience—that wet sand or dry sand was expensive to use, and correct conditions cannot be determined by *guesswork*.

That's the reason for the McIlvaine Moisture Meter. It tells at a glance, the exact moisture content of any sand. Just push it into the heap, and the meter indicates the relative moisture.



The New McIlvaine Moisture Meter provides improvements that are valuable. The Indicating Meter has been cushioned in live rubber to guard against jar and rough handling, and further protected by an extra dial cover of plate glass; the necessity of factory adjustment for different sands has been eliminated. Don't encourage spoilage with improper sand. Use a McIlvaine Moisture Meter and save the castings before they're made.

R. W. McILVAINE CO.

53 West Jackson Boulevard Chicago, Illinois

Kreick

Bond and Rebond MOLDING SANDS

with GOOSE LAKE Fire Clay Flour

Foundries making practically every type of malleable and gray iron castings now treat their molding sands with Goose Lake Fire Clay Flour.

The principle involved is considered one of the most important changes ever developed in foundry practice and is not only *economical* but permits the production of higher grade castings. Its adoption in many foundries has definitely proved that it:

1—*Rebonds worn out sand*
2—*Lowers cleaning costs*
3—*Makes smoother castings*
4—*Saves sand disposal expense*
5—*Reduces losses from bad castings*
6—*Cuts down purchase of new sand*

Goose Lake Fire Clay Flour is a very finely pulverized Fire Clay of great bonding strength and refractory value, prepared especially for the foundry trade.

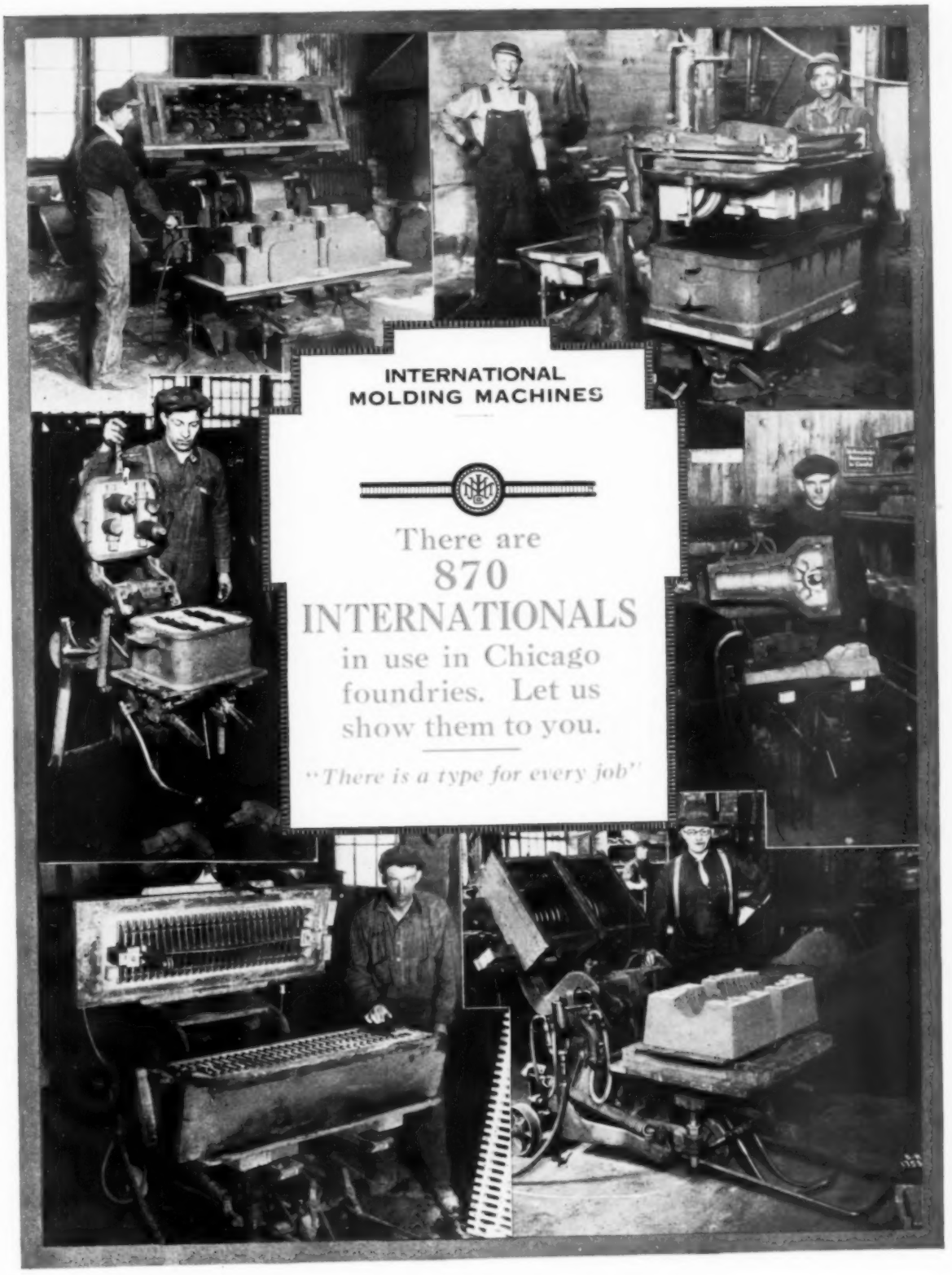
Write for booklet *"The Forward Step in Molding Practice,"* and data from the actual results obtained in foundries using Fire Clay Flour

ILLINOIS CLAY PRODUCTS COMPANY
Joliet, Illinois

GOOSE LAKE
Fire Clay and Fire Clay Flour

Illinois Clay Products Company
JOLIET ILLINOIS

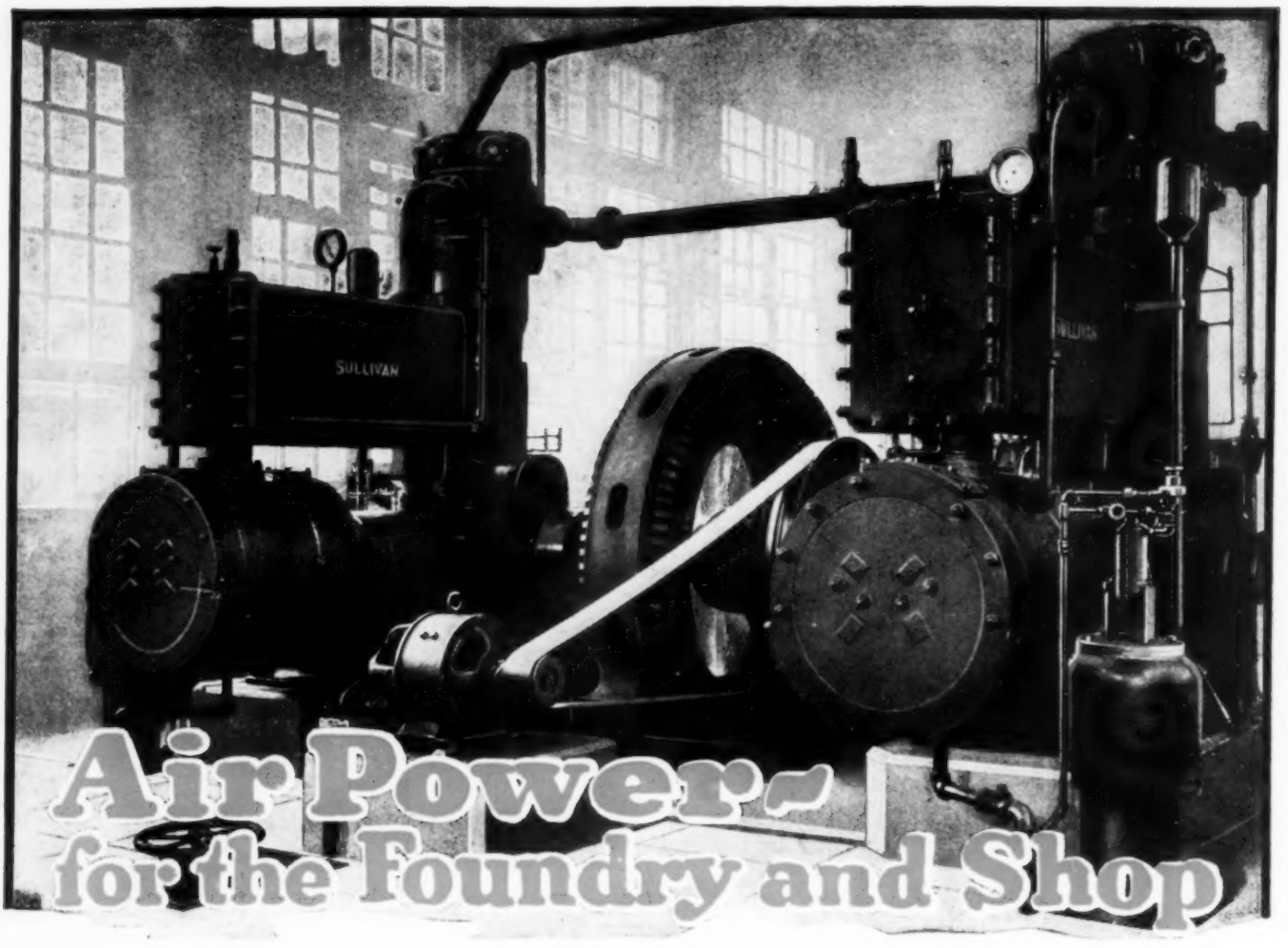
NOTE:—*Visitors to the Foundrymen's Convention in Chicago are invited to inspect our large modern clay grinding plant at Goose Lake near Joliet*



INTERNATIONAL MOLDING MACHINE CO.

2608-2624 West Sixteenth St.,

Chicago, Illinois



Air Power for the Foundry and Shop

Dependability Air power in your plant becomes more important with every air tool you add to speed production, and more and more of your labor is staked on the *dependability* of your air compressor. Dependability is probably the biggest reason why so many plants like your own, turn to Sullivan Angle Compound Compressors.

Economy But Angle Compounds save in other ways, too. When you install one of these compressors, your savings in floor space, foundations, and installation cost will run into hundreds, perhaps thousands of dollars. This is due to the compact, balanced angle design, and to the consequent "vibrationless" operation. Multi-step load control gives you the lowest possible power consumption at any partial load. "Wafer" valves, and positive automatic force-feed lubrication are features, which reduce attendance and maintenance cost to the minimum.

Flexibility When your plant has reached the capacity of a single Angle Compound Compressor, you simply add another, making a twin unit, and run both compressors from one motor. Thus you double your capacity, and have a flexible installation, as either one of the compressors can be run alone at full efficiency under partial demand. Angle Compound capacities range from 400 to 3700 ft. per min., and they are adapted to belt drive, or direct connection to electric motor, or oil or steam engine.

Depend on Sullivan Angle Compound Compressors

Long Life Many Sullivan Angle Compound Compressors built 15 years or more ago, are running efficiently today.—And Angle Compounds are the most modern air compressors you can buy. Let your next air compressor be a Sullivan Angle Compound. It will assure you dependable air power, at rock-bottom cost for installation, power, attendance, upkeep, and depreciation.

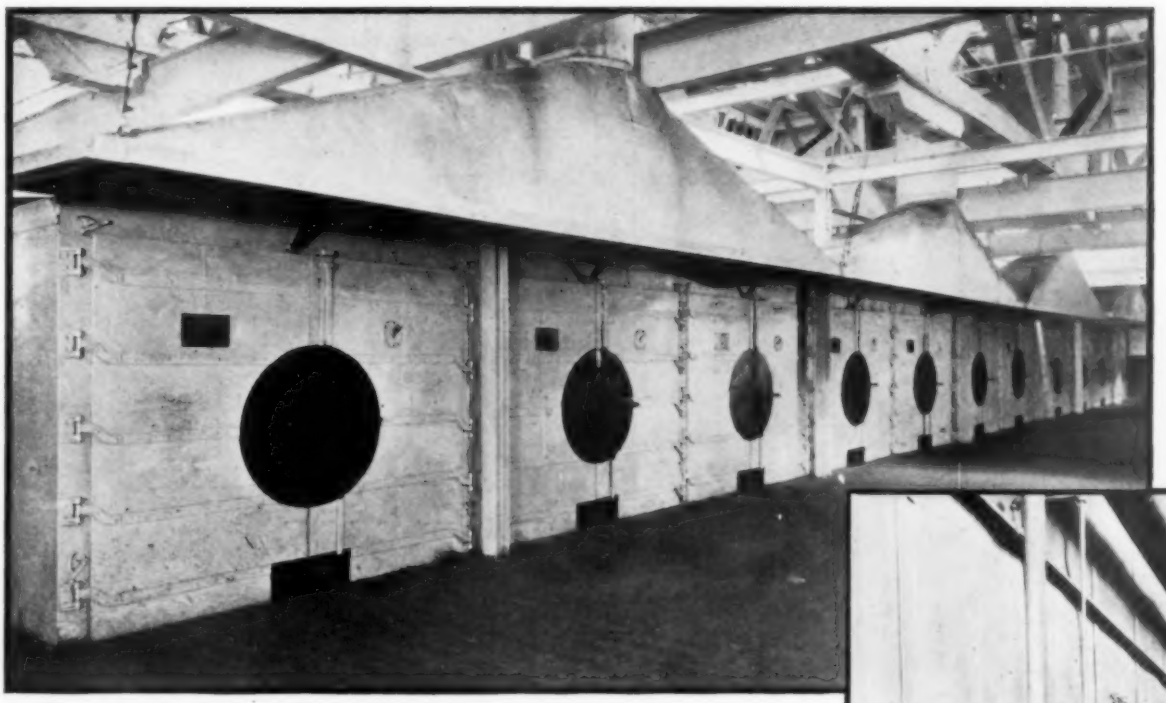
Write for Catalog 1883-A

When You Visit These Plants With the American Foundrymen's Assn. Look for the Sullivan Compressors

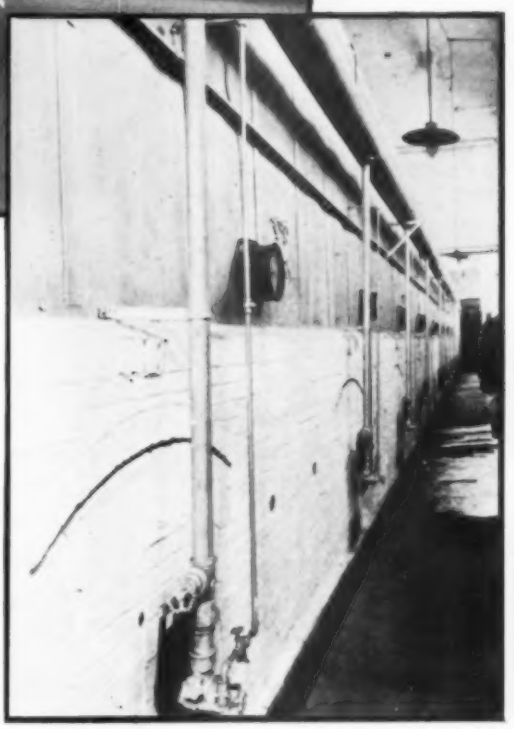
Nugent Steel Castings Co. Burnside Steel Foundry Chicago Steel Foundry Cribben and Sexton National Malleable and Steel Castings Co. Francis and Nygren Foundry Co. Chicago Hardware Foundry Whiting Corporation Co.

SULLIVAN MACHINERY COMPANY

146 SOUTH MICHIGAN AVE. CHICAGO, ILLINOIS U.S.A.



Battery of oil fired Swartwout Core Baking Ovens recently installed at the Standard Plant of the American Radiator Co., Buffalo. View at right shows firing aisle.



The pictures above show the equipment just as the camera saw it. Note the doors —5 hinges prevent sagging or distortion; note the perfect joints and other details in the larger picture; note the simplicity of the firing aisle.

Seventh Swartwout Contract for American Radiator

THIS new battery of Swartwout Core Baking Ovens at the Standard Plant marks the seventh installation in as many different plants of the American Radiator Company.

The value and efficiency of the Swartwout Metal Insulated Oven could have no better endorsement than this.

Design, efficiency, space requirements, weight, operating cost—these and other important points are all in favor of Swartwout Ovens.

As pioneers in Metal Insulated Oven construction, our engineers will bring to you an unusually valuable background of successful experience. The Swartwout Company handles the entire installation—there is one centralized responsibility when one complete contract is placed with us. We shall be glad to have an engineer call. Write or send the coupon.

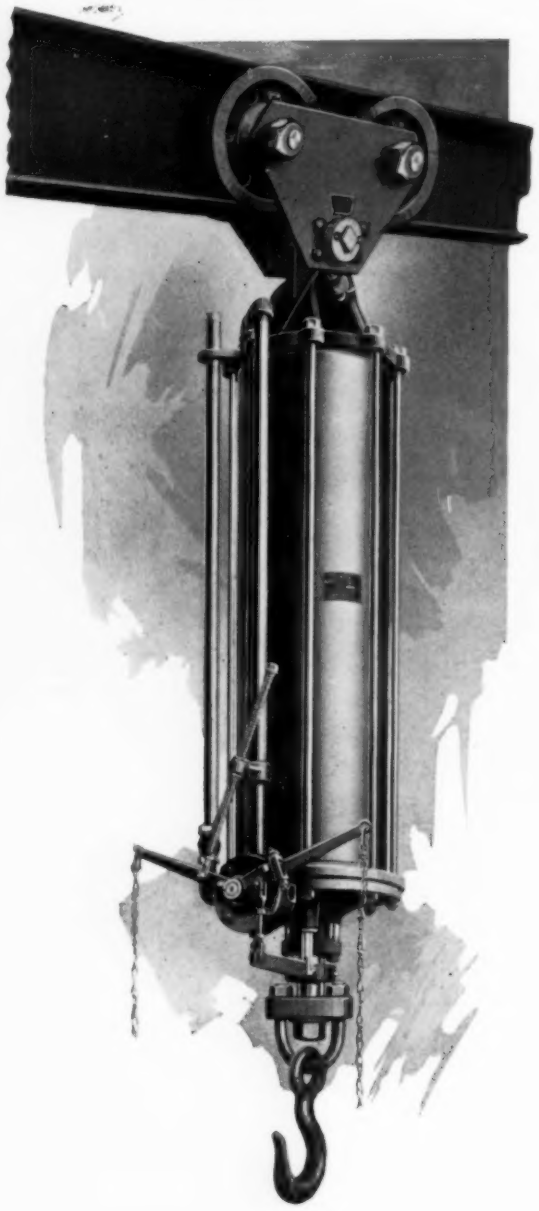
THE SWARTWOUT COMPANY
Executive Offices: 18531 Euclid Avenue, Cleveland
Factories: Cleveland and Orrville, Ohio

THE SWARTWOUT COMPANY
18531 Euclid Ave., Cleveland

We would like more information about Swartwout Metal Insulated Ovens. Please have your engineer call.

Signed .....
Firm Name .....
City .....
State .....

Swartwout
Metal Insulated Ovens



Your Hope of Profits

Lies to a large extent in the use of the best and cheapest method of material handling.

Hanna Air Hoists

Fill this very requirement

They are speedy; assure continuous service. Operating and maintenance costs are very low.

First cost lower than any other power hoist.

Investigate its possibilities
Write today for
Hanna Air Hoist Catalogue No. 14.

Hanna Engineering Works

Birmingham, Ala. Cleveland, O. Boston — 1761 ELSTON AVE., CHICAGO, U. S. A. — Detroit Los Angeles Montreal, Can. New York Richmond, Va. San Francisco St. Louis St. Paul

600 to 700 Ford Housings Daily

Made on each pair of Nicholls Type "D" Molding Machines with only one operator on each machine.

Over 300 Ford Truck Housings made daily from two Nicholls Type "D" Molding Machines (see shop view) with one operator only on each machine.

The two operators on each pair of machines, shovel the sand, handle the flask, make the molds complete, core them, set them out on the floor, clamp them and they also pour during the heats.

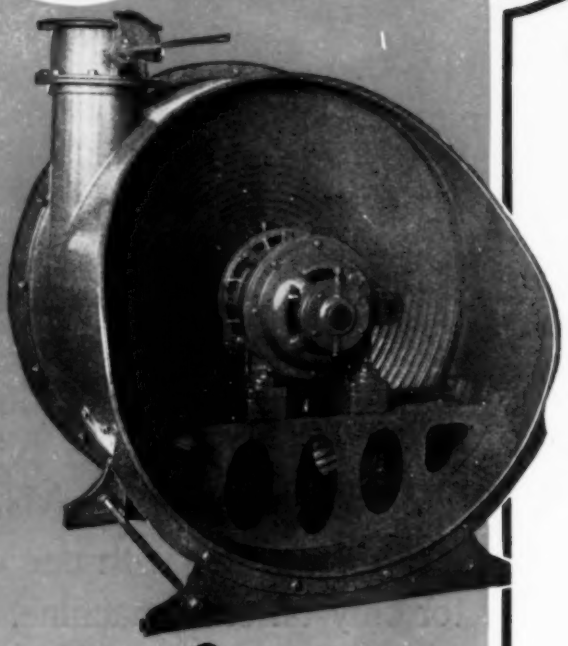
12-36 Heavy Duty Type "D"

12¼" Squeeze Piston — 6" Jolt Piston
36" between uprights — Weight 2,400 lbs.

WM. H. NICHOLLS CO., Inc.

2-10 College Place, Brooklyn, N. Y.

SPENCER
TURBO-COMPRESSOR



For CUPOLA AIR

Spencer Turbo-Compressors provide the most simple and effective control over cupola air conditions, both in volume and pressure, that can be obtained.

The air flow is even and steady and the pressure constant, all pulsation and surging is eliminated.

By connecting the motor and the turbo-compressor direct, all gears, belts or chain drives are done away with. This elimination results in less noise and no power loss.

The current consumption of Spencer Turbo-Compressors inherently decreases in proportion to reduction of volume of air used, eliminating all auxiliary governors.

We would like to tell you more about Spencer Turbo-Compressors and give you the names of some well known users. Write!

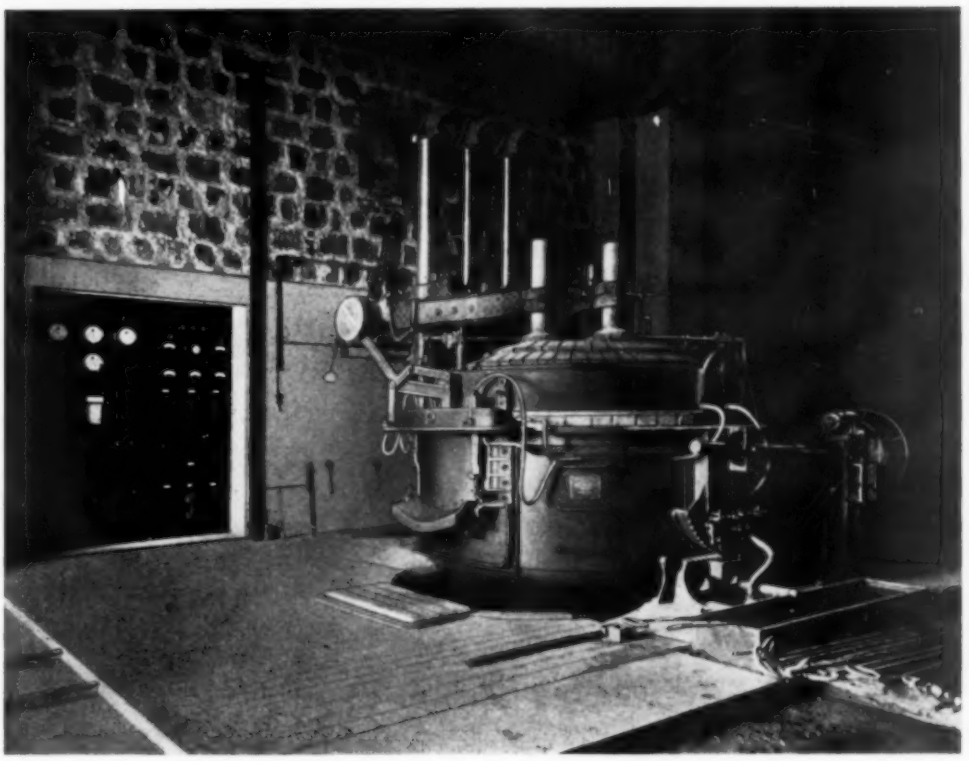
also for OIL AND GAS BURNING INDUSTRIAL FURNACES

THE SPENCER TURBINE CO.
HARTFORD, CONN

MOORE RAPID 'Lectromelt FURNACES

(W. E. MOORE PATENTS)

THE MOST RAPID AND ECONOMIC ELECTRIC FURNACES ON THE MARKET FOR THE PRODUCTION OF GRAY AND MALLEABLE IRONS, ALLOY AND CARBON STEELS



New Three Ton 'Lectromelt Installation

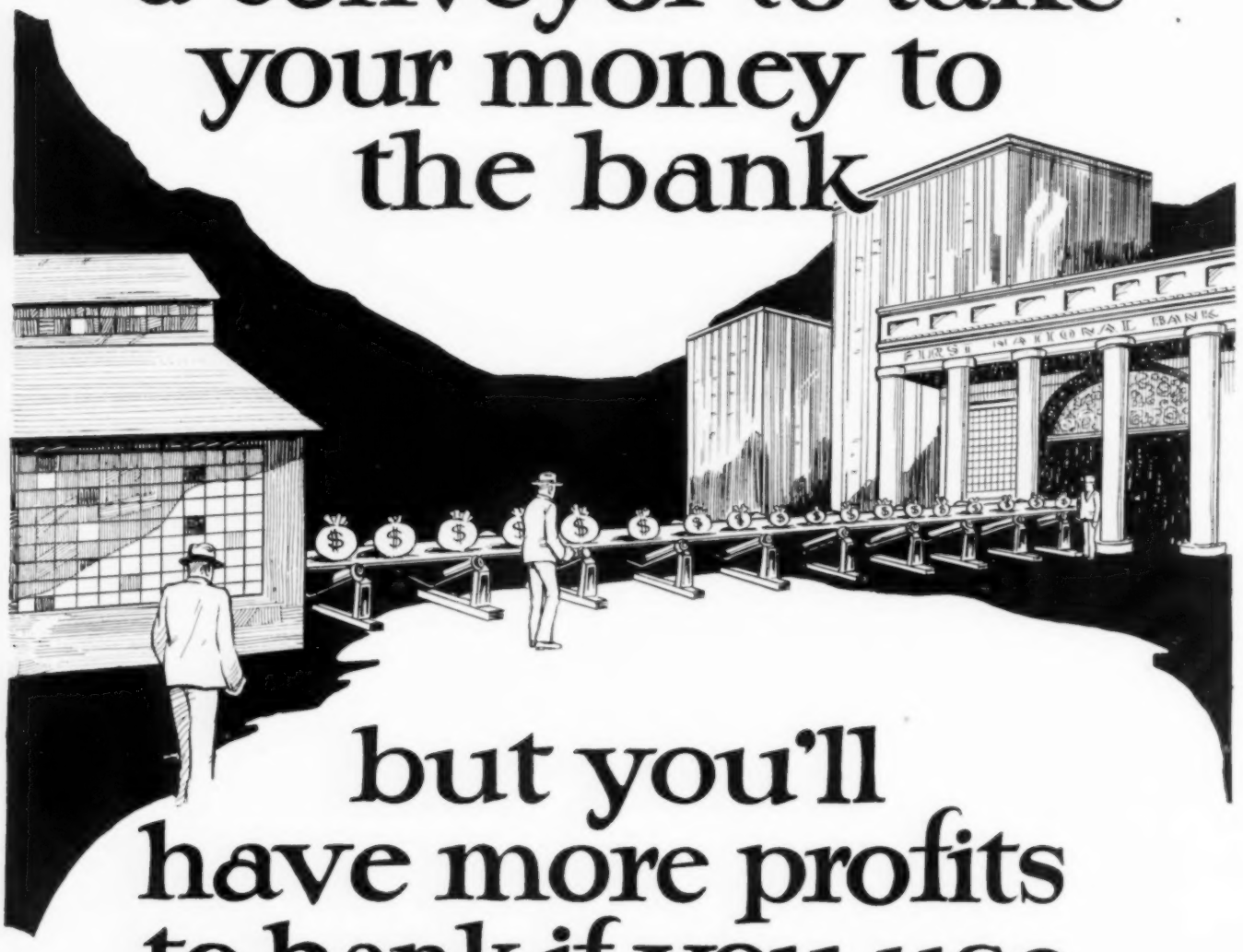
The illustration above shows the 'Lectromelt water-back counterweighted charging door. 'Lectromelt doors fit tight to retain the furnace heat and non-oxidizing atmosphere. 'Lectromelt doors are conveniently operated. They stay placed in any desired position.

ASK 'LECTROMELT USERS VISIT 'LECTROMELT INSTALLATIONS

Pittsburgh Electric Furnace Corporation
Pittsburgh, Penna.

Largest Manufacturers of Electric Furnaces Exclusively in the World

You may not need a conveyor to take your money to the bank



but you'll have more profits to bank if you use

MILLER-HURST EQUIPMENT

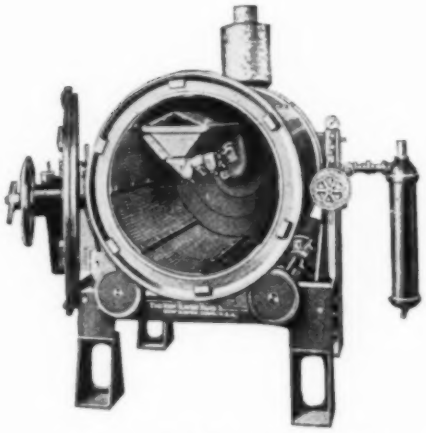
ENGINEERS and MANUFACTURERS

MILLER-HURST DETROIT

MATERIAL HANDLING EQUIPMENT

The Miller-Hurst Corporation
DETROIT

General Motors Building
MICHIGAN



The 4 staggered jets in this barrel are ideal for cleaning cores and work requiring thorough inside blasting such as small valves, roller bearings, carburetors, etc.

There is a New Haven Barrel for any work

This unit with either 2 suction or one direct pressure jet is very effective for cleaning small delicate castings such as gears and threaded parts.

Installations of the various types of NEW HAVEN BARRELS may be seen in operation at the following foundries in the CHICAGO DISTRICT:—

Western Foundry Co.
Stuart & Clark
Meaker Galvanizing Co.
Magnus Co.
Chicago Railway Equipment Co.
American Brake Shoe & Fdry. Co.
American Enamel Products Co.
Adams & Westlake Co.
Moline Malleable Co., St. Charles, Ill.
Walker Mfg. Co., Racine, Wis.

Realizing that one type of barrel will not suit all requirements, we manufacture six *distinct types* of sandblast barrels in different sizes to really meet the various problems of cleaning work effectively and economically.

Our hopper, radial, single end jet and double end jet barrels each have their field of application in cleaning work ranging from needles to automobile cylinder castings.

This barrel will handle a ¾ full load. The location of its radial jets allows cleaning of general miscellaneous jobbing work.

This large direct pressure barrel with double automotive tank is a quantity production unit effective in cleaning large steel castings and in scaling forgings.

"Quality Equipment Pays In The End"

THE NEW HAVEN SAND BLAST CO.

SANDBLAST BARRELS — ROOMS — CABINETS — TABLES — DUST ARRESTORS

New Haven, Conn. Cleveland, Ohio.

HYDRAULIC CASTING CLEANERS

After several years of experimenting we have perfected a hydraulic casting cleaner, suitable for cleaning all kinds of castings from medium to maximum sizes, and are now prepared to furnish such cleaners to founderies interested in:

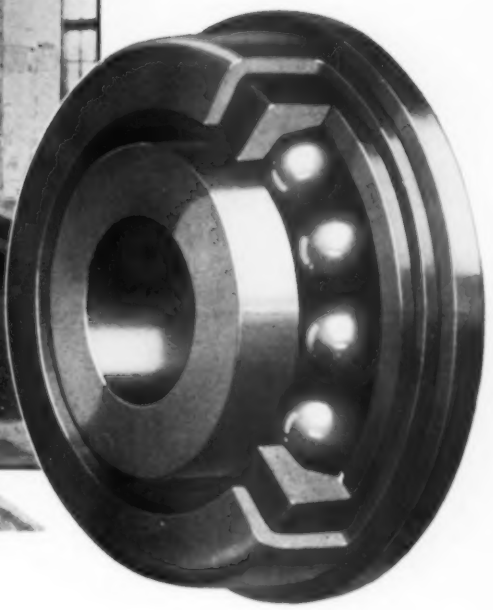
Reducing cost of castings
Cutting down production time
Reducing labor turnover
Improving safety and sanitary conditions

Our engineers will be pleased to co-operate with you in determining size of cleaner to meet your requirements.

You are cordially invited to inspect our Cleaner installation at Milwaukee, during your visit to the Foundrymen's Convention in Chicago June 6th to 11th.

ALLIS-CHALMERS MANUFACTURING CO.
MILWAUKEE, WIS. U.S.A.

View in James B. Clow & Sons Foundry, Chicago, showing lines of Mathews Conveyers.



You Can See Mathews Conveyers at Chicago

MORE than a dozen of the Chicago foundries named for inspection by Convention visitors, are users of Mathews Conveyers.

The following plants will be found particularly interesting from this standpoint:

James B. Clow & Sons
Belle City Malleable
Illinois Malleable
International Harvester
Superheater Company
Hammond Brass Company

Mathews Conveyers for Foundries are not sold "off the shelf". They are built for your industry, and individually engineered. Specially constructed rollers, bearings, dust and sand protectors, metal spillage guards and other features account for the popularity of Mathews equipment.

Nothing in the foundry gets harder wear than the conveyer. Nothing in the conveyer gets more abuse than the bearing.

So, in the Mathews Foundry Conveyer, the type 50 ball bearing is built with a special case hardened steel inner and outer race with twelve $\frac{3}{8}$" diameter hardened steel balls, all assembled in a pressed steel jacket. Easier movement of the balls is afforded by the center split outer race with triangular bearing surface, which gives reduced surface contact and a free running bearing.

MATHEWS CONVEYER COMPANY, 104 Tenth Street, Ellwood City, Pa.
New York, Boston, Philadelphia, Buffalo, Pittsburgh, Cleveland, Dayton, Detroit, Chicago, Atlanta, Anderson, S. C., New Orleans, Milwaukee, Minneapolis, St. Louis, Omaha, Denver, Salt Lake City, Los Angeles, San Francisco, Seattle.
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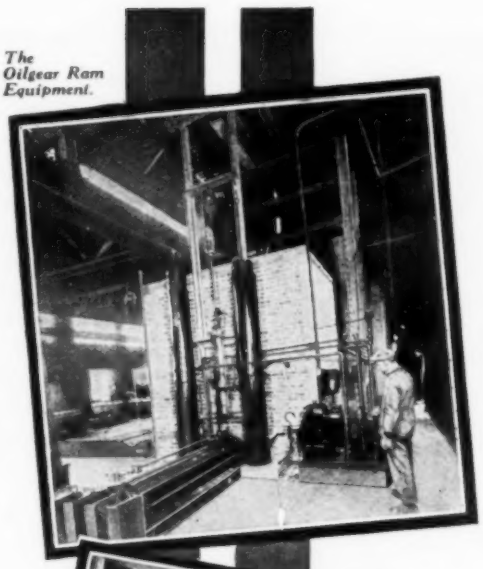
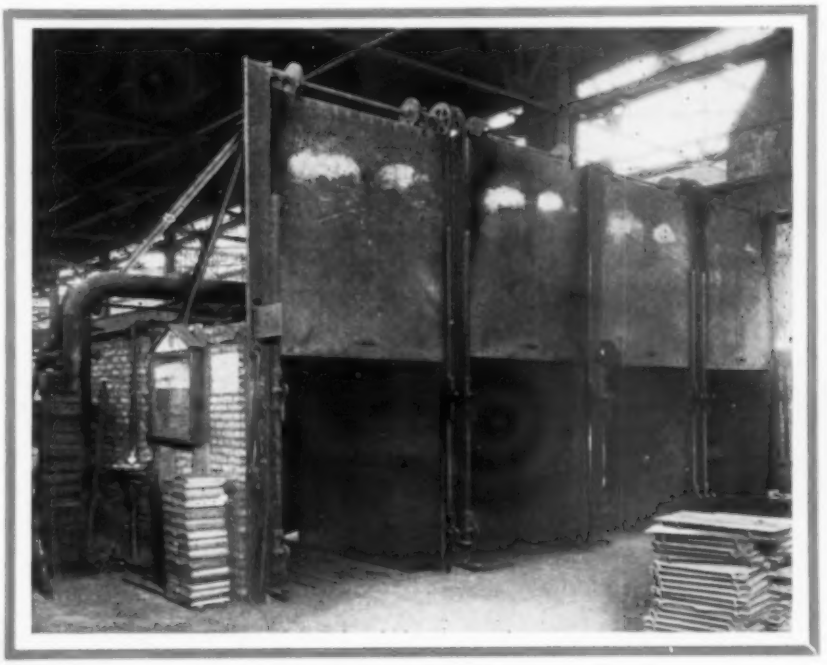
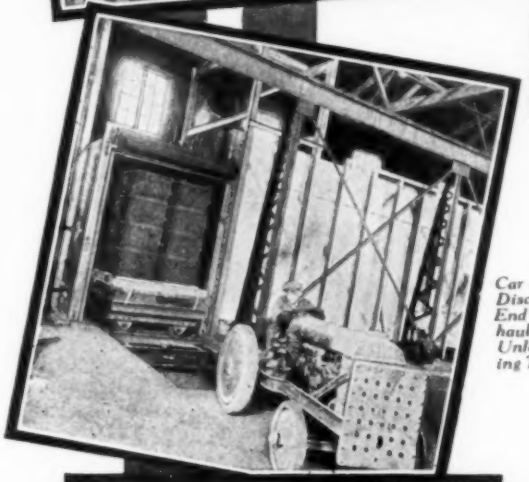


The Oilgear Ram Equipment.





Car at Discharge End being hauled to Unloading Truck.

The photograph above shows an installation of Holcroft & Company core ovens and equipment in the plant of Pettibone Mulliken Company, Chicago, who specialize in manganese steel castings for railroad and similar equipment.

The cores are manufactured on benches which occupy a space in front of the furnaces. The first three ovens are used for drying cores on portable racks which are placed in the oven and removed with an electric lift truck. The oven at the right is provided with a number of shelves to hold the cores while they are baking.

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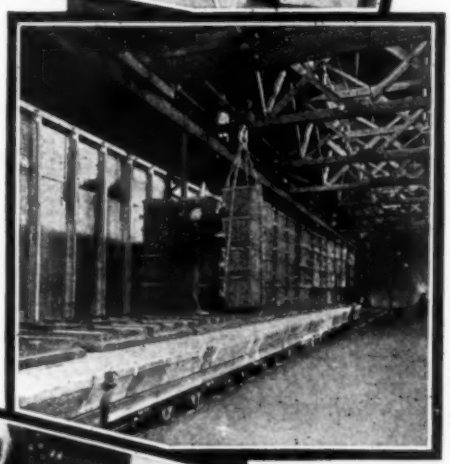
The photographs at the left and below are of the Holcroft Equipment in the plant of the Northwestern Malleable Iron Company, Milwaukee, Wis., after 18 months continuous operation.



Loading and Unloading Truck at Side of Kiln.

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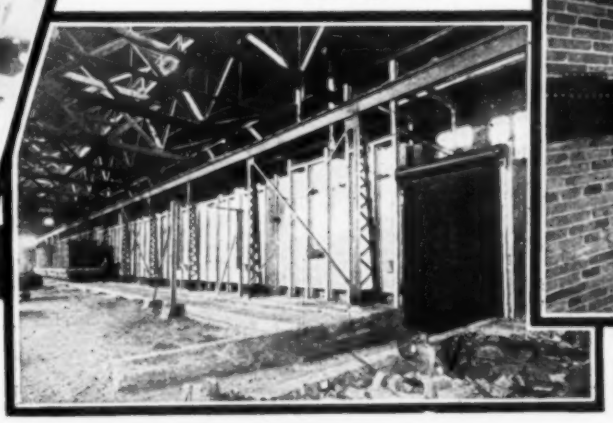

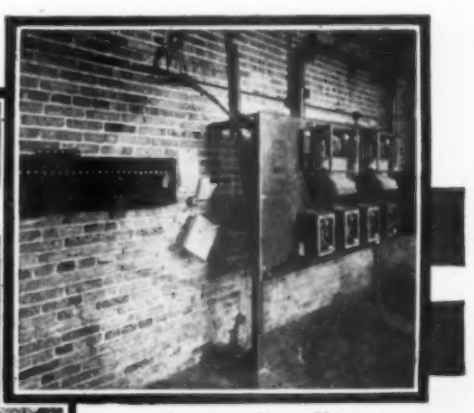

Instrument Room, Showing Recorders and Kiln Board.

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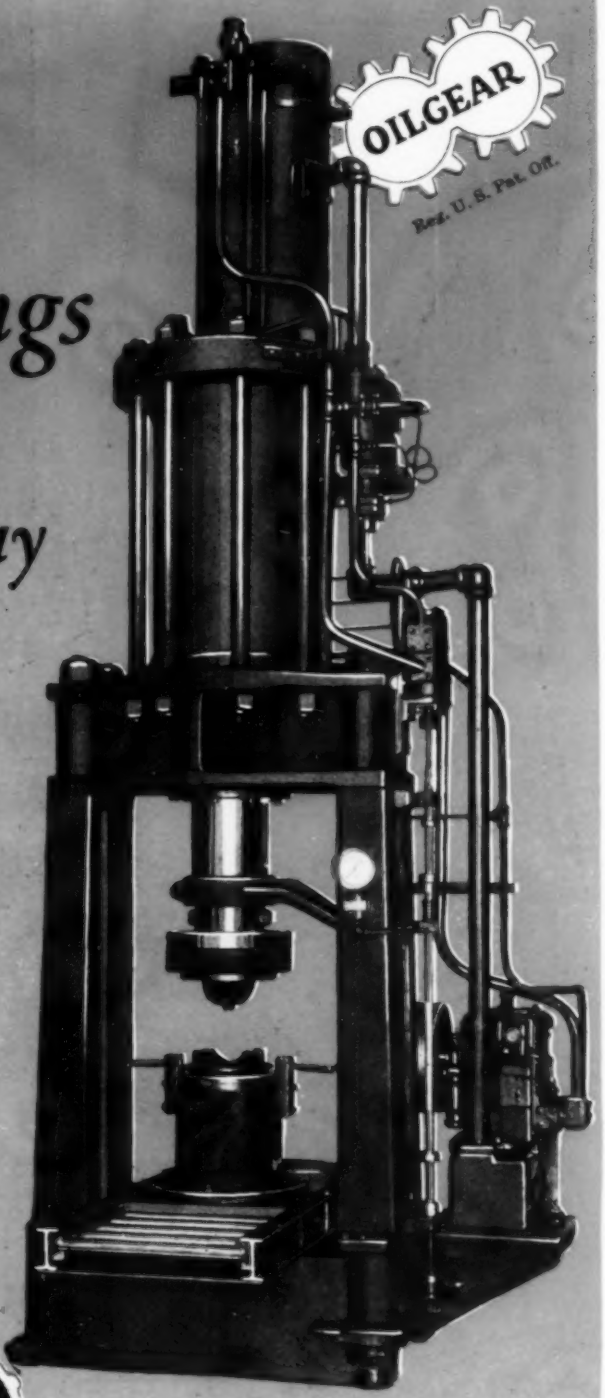

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PRESSES — BROACHING MACHINES — TRANSMISSIONS — PUMPS

Plan Schedule of Convention

International Foundrymen's Congresses Arranged by World Representatives—Discussions of Papers Prove Interesting at Annual Meeting of Belgian Association

IMPORTANT developments may follow the convention of the Association Technique de Fonderie de Belgique with respect to the future of international meetings. Representatives of the principal foundry organizations of the world assembled in Brussels at the convention of the Belgian association on April 10 and agreed upon a schedule for the coming conventions. It was decided in principle that an international congress will be held every three years in rotation in one of the following countries: Great Britain, Germany, France and the United States, the next important event will be held in London in 1929. Concurrently with these congresses, there will be organized international exhibitions covering all the activities of the foundry industries. At these functions the foundry organizations of every country, including the United States, will be represented by an official delegation. Between these international meetings, conventions of a more local character will be held each year in one of the countries of Europe. The next one which will take place in Paris in September, already has been announced in THE FOUNDRY.

The Belgian convention, which was held in Brussels on April 10 and 11, was opened by Paul Ropsy, managing director of the Societe Belge Griffin, Merxem-Anvers, and president of the Belgian association. Mr. Ropsy alluded to the success of the meetings which have taken place in the past year, particularly the Franco-Belgian congress in Liege, the London convention and exhibition in June last, the second international congress in Detroit, and the Czecho-Slovakian congress held at Prague in March. He stressed the international interest which is being taken in the activities of foundry technical organizations. He then asked Gustave Masson, past president of the association to take the chair and preside over the session. The first paper on the program was the exchange paper of the American Foundrymen's association, entitled "Heat Treatment of Gray Cast Iron and Semisteel", by O. W. Potter, of the University of Minnesota. This paper was presented by Ivan Lamoureux, vice president of the Belgian association, the translation having been made by Louis Piedbeouf, Embourg. Mr. Lamoureux, in introducing the paper stated that already he had alluded on previous occasions to the internal stresses which exist in castings. He then had recommended the use of soft irons, but had prophesied that scientific methods would enable the proper kind of pig iron to be used for each case, after a special treatment. Mr. Ronceray also had mentioned the possibilities

PAUL ROPSY

of heat treatment for cast iron. This paper confirms these suggestions. The presentation of the paper was followed by an interesting discussion. Mr. Varlet, foundry manager of the Societe Esperance-Longdoz, Liege, said that in a turbine factory a foreman had found deformations of the castings after machining. He then machined the pieces to 0.02 inches and heated them in a drying oven at about 200 degrees Cent. The pieces were finished and no more deformations were observed. As an improvement, Mr. Varlet suggested heating in a separate oven at 270 degrees, and good results were obtained.

Mr. Fabre, foundry manager of the Societe Bracq-Laurent, Achicourt, France, said that he doubted whether the same treatment will always give the same results. An engineer of the Usines Bollincx said that he had tried heat treating pistons and combustion chambers. They have given up reheating the combustion chambers because the different sections caused breakages. The results with pistons were satisfactory. Mr. Ropsy answered that in the manufacture of wheels made by his firm, the wheels have different sections and are made from different grades of pig iron. They are taken from the chill when still red and put into pits where they cool for a long time. It is found particularly advisable to remove the castings from the mold at the highest possible temperature and the pits also must be at a high temperature, at least 1000 degrees Cent. The time of cooling from 1000 degrees to 800 degrees is 24 hours. This procedure has given uniformly good results. Mr. Ropsy agreed that this is a special case and stated that he was under the impression that the author of the paper started the heat treatment from cold. Mr. Leonard, past president of the association, believes that the question still is theoretical and the methods indicated by Mr. Potter are too strict. He stated that pieces dipped in water at 870 degrees were broken. Mr. Lamoureux said that the heat treatment should be of the most interest when pieces contained different sections. The difficulty is to obtain an uniform temperature in all the points of the casting. Mr. Proyart, Cockerill's, Liege, said that reheating the casting for too long a time decomposes the iron. However, he had obtained satisfactory results with piston rings, tempered in air from a temperature of 750 degrees. The results were good in the winter but bad in the summer. He claimed that it is impossible to obtain homogeneous heating where there are large variations of section. The first condition to obtain sound castings is to use an iron of good quality. Mr. Proyart said that he tried heat treatment on castings for turbine parts, but he could never prevent deformation, and now he uses steel.

Mr. Ropsy said that it is true that a too long treatment decomposes the iron, but the question deserves to be studied further. Mr. Fabre suggested that experiments should be made on test pieces presenting different sections. The shape of the piece also has an influence. Another

speaker said that he had reheated certain parts three hours at 870 degrees Cent. and cooled them in air. When these parts were cooled in water there was a slight deformation and the pieces became so hard that they could not be machined. V. C. Faulkner, president of the Institute of British Foundrymen, said that one has to remember the influence of mass, to find all the possible effects of heat treatment before adding special elements, and added that in England castings have been obtained with a tensile strength of 70,000 pounds per square inch and were comparable with forged steel.

Discuss Technical Training

The afternoon session was presided over by Ivan Lamoureux, vice president of the Belgian association. The first paper was presented by Arthur Soupart, director of the Musee Professionnel de l'Etat et des Ecoles Techniques de Morlanwelz. The subject of his communication was "Professional and Technical Training With Respect to the Foundry Industry." In the discussion, in which Mr. Ropsy, Mr. Leonard, and Mr. Espana, of Etablissements Bonvillian et Ronceray, Paris, took part, it was apparent that there are two schools of thought, the one in favor of training in special technical schools, the other in favor of training in the foundry shop. The objection to the school is that it does not have the atmosphere of the shop, while the shop can hardly give methodical teaching. Mr. Espana said that the aim is to combine the two necessary requirements, which should be possible.

One speaker pointed out the method used in the University of Cincinnati, Cincinnati, where the school students spend periods of two to three months in foundries under ordinary working conditions.

The next paper on "The Manufacture of Large Castings" was the exchange paper of the Association Technique de Fonderie de Paris and was presented by Henri Fabre. Mr. Fabre reviewed the organization of the shop, the material necessary for casting heavy pieces, making of the patterns, precautions during the molding operation, shrinkage and the defects generally encountered. Mr. Lamoureux emphasized the importance of venting. In answer to these remarks, Mr. Varlet summarized his work on the subject which was published in France some months ago, in which he gave formulas for the calculation of the speed of pouring, the section of vents, risers, etc. Other speakers gave the results of their particular experiences and the difficulties they met with, and it was recognized generally that the whole casting must be studied completely before the pattern is made and that this study should be conducted by the engineer in charge.

The final session took place on the morning of April 11, Mr. Varlet, vice president of the association in the chair. Mr. Ropsy presented a paper entitled "Contribution to the Study of Carbon in Pig Iron." This paper gives the results of experiments conducted in the author's works and contains diagrams and micrographs showing the influence of the contents of carbon, and temperature on the iron. Mr. Varlet, Mr. Ronceray, Mr. Espana and Mr. Lamoureux discussed the merits of the pyrometer and of the test piece developed by Cury for the pouring qualities of pig iron, and it was agreed that each method complements the other in their respective domains. The experience of the man in the works is also necessary. The pyrometer does not give the temperature inside the ladle, but that of the surface of the bath. This factor, to which should be added the personal equation of the observer, may cause errors which may attain 8 per cent. The discussion then took a scientific character and centered between Mr. Ronceray, Prof. Rabozee and Mr. Leonard, who discussed the formation and the presence of graphite in cast iron. The final paper was that presented by Ferdinand Kayser, Sheffield, England, who presented the exchange paper of the Institute of British Foundrymen. The subject of the paper was "The Manufacture and the Utilization of Castings in Nickel-Chrome-Iron and Cobalt-Chrome-Iron." It was pointed out in the discussion that these alloys are a valuable addition to the range of alloys already existing, but that they will not supersede certain other alloys such as copper-aluminum and others, as each one meets a particular requirement in a special sphere.

Attend Banquet

This session was followed by a banquet which was attended by members of the foundry associations of seven nations, including Belgium. Those present who expressed their thanks to the Association Technique de Fonderie de Belgique were Emile Ramas, honorary president of the French technical association, Dr. S. Werner, president of the German foundry association, V. C. Faulkner, president of the Institute of British Foundrymen; the president of the Dutch association; Mr. Espana, representing the foundrymen of Spain; and Vincent Delport, European representative of the American Foundrymen's association. Telegrams were received from the American Foundrymen's association, and the associations of Czecho-Slovakia and of Italy.

Discuss Management

The American Management association in co-operation with the management division of the American Society of Mechanical Engineers and the Detroit section of the Society of Automotive Engineers held a conference from April 27 to 29 at the Book-Cadillac hotel, Detroit. Papers were presented by Oscar Grothe, White Sewing Machine Co.; Wallace Clark; Carl J. Scherer, Marmon Motor Car Co., Indianapolis, Ind.; L. I. Shaw, Western Electric Co. Inc.; C. S. Craigmile, Belden Mfg. Co.; L. P. Alford, editor, *Manufacturing Industries;* G. G. Rehmer, Perfection Stove Co.; Frank J. Tone, Carborundum Co.; W. S. Berry, Scovill Mfg. Co.; E. E. Vender, Ernst & Ernst; H. G. Perkins, Chrysler Corp.; and J. D. Towne, industrial engineer, Dayton Steel Foundry Co., Dayton, O.

Mr. Towne stated that time study is the most important phase of present day management. He described the method used at the Dayton foundry to control production. All orders are sent to the production department where schedules are worked out. Man-hours for all departments are worked out according to the amount of work scheduled, and this has been developed from a study of the hours worked previously. The comptroller has a master sheet which details the number of hours for each department for any amount of work from when the plant may be shut down up to 100 per cent capacity. The previous day's hours are posted on the master sheet by 10 a. m. and a short study of the figures allows the comptroller to keep the situation well in hand. An accurate budget and immediate follow up brings the expense of labor under absolute control. A given production must be obtained, and not more than a stated number of hours may be used in reaching this production.

Will Hold Exhibit

The fifth exhibition of chemical apparatus and appliances will be held at Essen, Germany, from June 7 to 19. Simultaneously, the principal conference of the Association of German Chemists will be held. The exhibition will be held in five halls situated on the exhibition grounds in the Norberstrasse at Essen.

Phosphorus and Titanium Retard Growth of Cast Iron

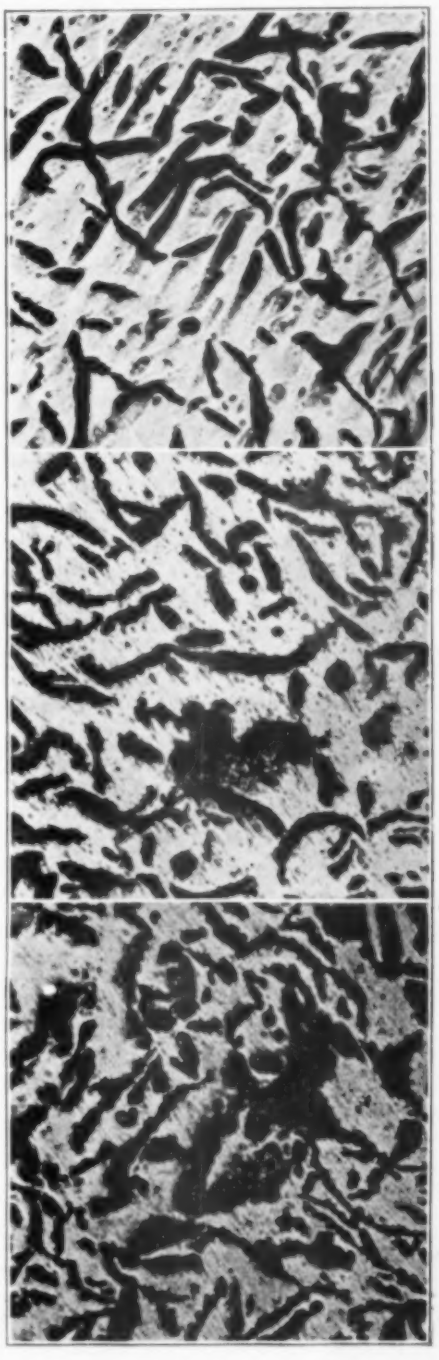
By R. R. Kennedy and G. J. Oswald

WORK described in this article was undertaken with the idea of developing a gray iron having a slow rate of growth under repeated heatings above the critical range, and which could be produced by the addition of various alloys to gray iron in the ladle.

Outerbridge in the *Transactions* of the American Institute of Mining Engineers, 1905, made a scientific study of this subject of growth of cast iron. Carpenter and Rugan in the *Journal* of the Iron and Steel Institute, 1909, No. II, and later Carpenter in the same journal, 1911, No. I, made thorough investigations from which they concluded, that growth is due to oxidation of the graphite by the oxygen of the air, hence, that all cast irons containing graphite grow on heating above the critical range, the growth being accelerated by silicon, but retarded by sulphur, phosphorus and manganese. They developed an iron containing 0.4 per cent silicon, 2.7 per cent carbon and 1.6 per cent manganese which showed practically no growth under repeated heatings. Due to its low silicon content, this iron could not be made in a gray iron foundry. Okochi and Sato in the *Journal* of the College of Engineering, Tokio Imperial university, 1920 observed that a small amount of growth takes place when cast iron is heated in a vacuum. They also

Try Various Alloys

VARIOUS alloys were added to iron in the ladle in an attempt to develop a gray iron which would have a slow rate of growth under repeated heatings. Of the alloys investigated, the addition of phosphorus and the deoxidation with titanium were found to have the greatest effect in retarding growth. The authors, R. R. Kennedy and G. J. Oswald are connected with the research department, National Cash Register Co., Dayton, O. The article is abstracted from a paper presented at the Detroit convention of the American Foundrymen's association, Sept. 27 to Oct. 1, 1926.



Left, Top bottom

Fig. 1—High silicon iron as cast showing original structure. Fig. 2—High silicon bar 1-A after 50 heatings, showing structure of core. Fig. 3—Same as Fig. 2, except showing structure near surface. All micros unetched, 100 X

Right, top to bottom

Fig. 4—Low silicon iron as cast showing original structure. Fig. 5—Low silicon iron bar 2-A after 50 heatings showing structure of core. Fig. 6—Same as Fig 5, except showing structure near surface. All micros unetched, 100 X

Table I

Composition of Bars Used in Experiments

Bar No.	Sulphur Per Cent	Phosphorus Per Cent	Manganese Per Cent	Silicon Per Cent	Total Carbon Per cent	Nickel Per Cent	Chromium Per Cent
1	0.070	0.60	0.58	2.90	3.12	.....	.....
2	0.080	0.52	0.51	2.19	3.54	.....	.....
3	0.068	0.61	1.51	2.39	3.41	.....	.....
4	0.076	1.56	0.52	2.88	2.96	.....	.....
5	0.083	0.49	0.45	1.84	3.23	1.12	0.17

Table II

Growth of Bars Under Repeated Heatings

	—Growth in Length of 5 Inches—					—Growth in Diameter of 1 Inch—					
Bar No.	1st Heating	6th Heating	11th Heating	25th Heating	50th Heating	1st Heating	6th Heating	11th Heating	25th Heating	50th Heating	Increase in volume per cent
1	0.0168	0.0375	0.0917	0.230	0.422	0.0036	0.0076	0.0217	0.038	0.078	26.24
1-A	0.0194	0.0424	0.1134	0.201	0.548	0.0048	0.0096	0.0309	0.040	0.117	38.48
2	0.0323	0.1178	0.3438	0.457	0.511	0.0070	0.0248	0.0733	0.096	0.095	32.20
2-A	0.0358	0.1258	0.2428	0.387	0.495	0.0075	0.0248	0.0507	0.084	0.100	32.77
3	0.0249	0.0477	0.1467	0.324	0.542	0.0056	0.0099	0.0207	0.064	0.113	37.25
3-A	0.0230	0.0530	0.1350	0.288	0.487	0.0055	0.0098	0.0255	0.053	0.092	30.75
4	0.0055	0.0102	0.0632	0.112	0.169	0.0012	0.0032	0.0179	0.044	0.067	17.63
4-A	0.0056	0.0132	0.0472	0.086	0.137	0.0022	0.0032	0.0136	0.032	0.061	15.64
5	0.0293	0.0889	0.2589	0.387	0.444	0.0060	0.0192	0.0514	0.079	0.084	28.15
5-A	0.0291	0.0993	0.2613	0.393	0.436	0.0062	0.0192	0.0561	0.079	0.086	28.32

Growth given in inches.

found that the same amount of growth takes place in cast iron when heated in an atmosphere of hydrogen, as when heated in air. Andrew and Hyman in the *Journal* of the Iron and Steel Institute, 1924, also working on the problem of growth in cast iron, found that nickel and aluminum accelerate growth while chromium retards it.

Iron used in this recent investigation was cupola melted metal, only the regular foundry mixtures being used. Bars numbered 3 were poured with the addition of 1 per cent of metallic manganese to a hand ladle of the lower silicon mixture. To the high silicon iron used in bars numbered 4, 1 per cent phosphorus in the form of ferrophosphorus was added. In making bars numbered 5, 1 per cent of nickel shot and 0.5 per cent of chromium in the form of ferrochromium were added to a ladle of the lower silicon iron. The iron did not take up all of the chromium due to its high melting point.

As the bars were poured from different heats, some variation in composition occurs. Analysis of the various bars is given in Table I. Iron was poured into bars 1¼-inch in diameter and 14 inches in length. These bars were cut in two and machined down to a diameter of 1 inch and a length of 5 inches. The ends of the bars were ground parallel carefully. Two bars from each mixture were used in this work.

Length of the bars was measured by a surface block, a surface gage and a set of Johansson blocks. The diameter was determined by a micrometer, care being taken to make the measurement in the same place each time. The first measurements were made to the nearest ten-thousandth of an inch, but after a few heatings, the warpage of the bars was so great that such accuracy was impossible and they were therefore measured to the nearest thousandth.

To prevent excessive scaling, the bars were packed in a steel pot with cast iron borings and the lid was luted with fire clay. The pot was heated in a gas-fired muffle furnace to a temperature of 1550 degrees Fahr. plus or minus 50 degrees, the duration of each heat being 3 hours. The bars were unpacked and measured after the first, sixth, eleventh, twenty-fifth and fiftieth heatings. Results are as shown in Table II.

Bar 1-A, poured from the high silicon mixture had the highest rate of growth of any bar tested. It was cracked badly on the surface. Bar 1 did not grow as rapidly as Bar 1-A, but it also contained a number of surface cracks. Bars 2 and 2-A, poured from the lower silicon mixture, had a high rate of growth, but neither bar showed any evidence of surface cracks. Bars 3 and 3-A, from the high manganese mixture, also had a high rate of growth, showing that this quantity of manganese did not have a retarding effect on growth of iron of the composition used. Both of these bars contained slight surface cracks.

Bars 4 and 4-A, from the high phosphorus mixture, showed a minimum growth of any bars tested. They were in good condition at the conclusion of the tests and showed no evidence of surface cracks. Tests showed that the addition of nickel-chromium to the low silicon mixture had a small retarding effect on the rate of growth. These bars likewise gave no evidence of cracking.

All bars on examination were found to contain a core of fairly sound metal surrounded by an outer area which was spongy in appearance. The size of these cores varied, the high silicon bar, 1-A, which showed maximum growth, having the smallest core, and the high phosphorus iron, bars 4 and 4-A, having the largest cores of sound metal.

As no attempt had been made to deoxidize the iron used in these bars, it was thought that any gases present might have had an accelerating effect on the rate of growth. As in the previous tests the high phosphorus bars gave best results, as regards rate of growth, while those bars poured from the high silicon mixture were considered most inferior due to excessive cracking as well as a high

Table III

Composition of Bars Used in Tests

Bar No.	Sulphur Per Cent	Phosphorus Per cent	Manganese Per Cent	Silicon Per Cent	Total Carbon Per Cent
6	0.076	0.58	0.63	2.93	3.21
7	0.070	1.67	0.64	2.80	3.06
8	0.074	0.60	0.60	2.81	3.24
9	0.069	0.57	0.69	2.98	3.33

NOTE: Bars numbered 6 and 7 poured from iron deoxidized with titanium. Bars numbered 8 and 9 are control bars. Iron was not deoxidized.

Table IV

Growth of Bars Made from Deoxidized Iron

	—Growth in Length of 5 Inches—				—Growth in Diameter of 1 Inch—				
Bar No.	1st Heating inches	6th Heating inches	11th Heating inches	25th Heating inches	1st Heating inches	6th Heating inches	11th Heating inches	25th Heating inches	Per cent Heating in volume
6	0.022	0.031	0.043	0.076	0.0046	0.0094	0.0121	0.0228	6.34
6-A	0.029	0.039	0.049	0.079	0.0055	0.0088	0.0128	0.0259	6.90
7	0.019	0.026	0.034	0.057	0.0037	0.0060	0.0108	0.0224	5.86
7-A	0.020	0.028	0.037	0.056	0.0048	0.0078	0.0129	0.0202	5.18
8	0.036	0.047	0.075	0.193	0.0077	0.0113	0.0194	0.0450	13.37
9	0.022	0.040	0.052	0.129	0.0042	0.0100	0.0137	0.0352	9.90

NOTE: Bars numbered 6 and 7 were poured from iron deoxidized with titanium. Bars numbered 8 and 9 are control bars. Iron was not deoxidized.

rate of growth. A new set of high phosphorus bars and a new set of high silicon bars were poured from metal in which a deoxidizer was used.

These bars were poured from the same tap of the cupola. To each ladle of iron 0.25 per cent of titanium in the form of ferrotitanium was added. That complete deoxidation might take place, the iron was stirred and held in the ladle as long as possible. It then was skimmed carefully and the bars poured. Two control bars in which the iron was not deoxidized were poured from the same heat. The composition of these bars is given in Table III. All bars then were machined, measured and heated as in the previous experiments, except that the work was stopped after the twenty-fifth heating. Results are as shown in Table IV.

All bars tested grew less than the bars of similar composition in the first series of experiments at the end of 25 heatings. The difference in rate of growth between the deoxidized specimens and the control bars, i. e., those to which no deoxidizing agent was added, was marked. The results indicate that a strong deoxidizing agent such as titanium has a powerful effect in retarding growth. High phosphorus bars again showed the slowest rate of growth, but this difference was much less than in the first series of experiments.

Photomicrographs show the effect of heating on the irons used in the first series of experiments. The *as cast* structure is given in each case for comparison with the structure near the surface, and in the core of the bars after 50 heatings. The structure of the bars near the surface in all cases is altered greatly. Structure of the iron in the core shows some alteration in all cases except that of the

Left, top to bottom

Fig. 7—High manganese iron showing original structure. Fig. 8—High manganese iron bar 3-A after 50 heatings showing structure of core. Fig. 9—Same as Fig. 8, except showing structure near surface. Fig. 10 High phosphorus iron as cast showing original structure. Fig. 11—High phosphorus bar 4 after 50 heatings showing structure of core. All micros unetched. 100 X

Right, top to bottom

Fig. 12—High phosphorus bar 4-A after 50 heatings showing structure near surface. Fig. 13—Nickel-chromium iron as cast showing original structure. Fig. 14—Nickel-chromium bar 5 after 50 heatings, showing structure of core. Fig. 15—Same as Fig. 14, except showing structure near surface. All micros unetched, magnified 100 X. Fig. 16—High phosphorus iron after 50 heatings, showing steadite envelop around grains of iron. Etchant 2 per cent nitric. X 100

FIG. 17—HIGH SILICON IRON AFTER 50 HEATINGS, SHOWING GRAIN STRUCTURE. ETCHANT 2 PER CENT NITRIC, X 100.

high phosphorus iron as shown in Fig. 11. Photomicrograph in Fig. 16 shows the large amount of steadite in the core of the high phosphorus iron. It will be noted that the steadite envelopes the grains of ferrite. This may be compared with Fig. 17 which shows the grain structure of the high silicon iron. In this case there is no steadite *envelop.*

Conclusions Are Drawn

As a result of the work described in this article the following conclusions were reached:

Of the irons tested, the high phosphorus iron had the slowest rate of growth.

An iron deoxidized with titanium grows much more slowly than a cupola melted iron of the same composition, but without the titanium addition.

As an explanation of these observed phenomena the authors suggest the following:

The steadite in high-phosphorus iron in photomicrographs in Figs. 16 and 18 forms an envelop around the grains of iron. This steadite envelop has the effect of slowing down the rate of penetration of the gases which cause growth.

If growth be due, as is commonly held, to the action of oxygen or other gases; in a deoxidized iron, the growth must all be caused by gases which penetrate from the exterior of the casting and are not caused, in part, by gases already in the iron. For that reason the rate of growth of a deoxidized iron would be slower.

Link-Belt Co., Chicago, has opened a new branch sales office at 229 Brown-Marx building, Birmingham, Ala. W. H. Norton, for many years connected with the Chicago office will be manager of this office assisted by H. R. Haught.

Five Industrial Cities Combine Forces

(Concluded from Page 384)

a boy can get no further in school he is fit only for industry. On the other hand industry is entitled to and needs the best that the school has to offer. A friendliness has sprung up between industry and the school that never existed before in the history of any of the cities involved. Each understands the problems of the other and a true friendship arises that spells success to this important undertaking.

The tangible results best may be analyzed from the number of apprentices enrolled as shown in the following table:

Type of trade	Apprentices enrolled
Foundry	42
Machine Shop	52
Pattern Shop	17
Sheet Metal	1
Electrical	2
Drafting	2
Office	1
Manufacturing or production	2
	119

True results best may be measured in light of a statement made by one of the foremast leaders of the community who said "For 18 years the apprenticeship program of this community was a before breakfast and after dinner subject for discussion, but nothing tangible was accomplished. In one year we have over 100 boys at work in various trades in practically every shop in the Tri-Cities, a degree of success never hoped for in the first year of our program."

Indicative of success frequently is the display of co-operation in time of stress. This has been experienced. To cite a specific case one plant usually stable in its production became slack and found that it would be difficult to give the apprentices the type of work called for at that particular time of their training. The situation was met with no trouble at all for other shops were willing to employ the apprentices of this plant for several months and provide the work required. Co-operation of this sort is the barometer of the real progress of the apprenticeship program in the community. The interchange of apprentices for special training has worked out to the satisfaction of all concerned.

Further developments constantly are taking place. At this time there is under way a news bulletin especially for the apprentices. The enthusiasm shown for minor considerations of this kind is worthy of note, for the interest of the apprentice in his publicity is proof of his contentment. Annual dinners and special technical programs to suit the needs of the boys have been planned and now are under way. Plans for continual publicity to imprint indelibly the apprentice idea into the minds of the people of the communty are complete. It has been found that an added interest in education has been taken by the various employes that will have to be met from time to time.

The foundry industry never has lost sight of the urgent need for apprentices and this fact has been evidenced by the amount of time given to the various apprentice activities of the national conventions, and the effort and money spent by other associations in this work.

Any individual plant or group of plants may have a worth while apprenticeship program provided a skilled personnel can be found to organize and administer an effective training program. The day is dawning when skilled molders and their co-workers will be efficiently trained in organized apprenticeship course.

Now Is Branch Manager

R. F. Mitten, formerly territorial salesman for the Black & Decker Mfg. Co., Towson, Md., in southern Ohio, recently was appointed branch manager of the Cleveland office of the firm. He occupies the vacancy left by C. M. Hall who was promoted to assistant automotive sales manager.

Brazelton, Wessendorff & Nelms Inc., 317 Preston avenue, Houston, Texas, has been appointed sales agent by the Whiting Corp., Harvey, Ill.

FIG. 18—HIGH PHOSPHORUS IRON AS CAST, SHOWING STEADITE "LAKE." ETCHANT 2 PER CENT NITRIC, X 500.

Gives Useful Pointers

on Modifying

Aluminum-Silicon Alloys

By R. S. Archer and L. W. Kempf

THE structure of aluminum-silicon alloys may be refined in a rather remarkable manner, with consequent improvement of physical properties, by certain treatments applied to the molten metal shortly before casting. Differences between the treated and the untreated alloys are so marked that special terms are used to distinguish them, the untreated alloys being referred to as *normal* and the treated alloys as *modified.*

The first practical method of accomplishing this result was that of A. Pacz, which consists in treating the molten metal with a salt flux of which the active ingredient is sodium fluoride. The result also may be brought about, and in a more economical manner, according to Edwards, Frary and Churchill, by the addition of small quantities of metallic sodium or potassium to the molten alloy shortly before casting. The action of the flux developed by Pacz evidently consists essentially in the production of free sodium by the reaction of sodium fluoride with aluminum. Changing a normal alloy to a modified alloy is referred to as *modification* and any process for accomplishing this result is a *modifying* process.

Modified aluminum-silicon alloys were introduced several years ago, and it has been demonstrated both in the laboratory and in commercial practice that it is no simple matter to produce castings having the maximum or nearly the maximum properties which under favorable circumstances may be obtained. The alloys are rather sensitive to small changes in chemical composition, and the modifying process must be carried out in a particular manner to obtain the best results. Extensive experimental work has been carried out in the laboratories of the Aluminum Co. of America with the object of determining the conditions that must be observed to make these alloys of the greatest possible value. It was necessary to learn how to control the modifying process before exact work could be done on the effects of alloy composition.

Aluminum and silicon form a simple eutectiferous system, with no chemical compounds. The melting point of pure aluminum is 660 degrees Cent., while that of silicon is taken as 1420 degrees Cent. The normal eutectic alloy contains about 11.6 per cent silicon and melts at 577 degrees Cent. Silicon is soluble in solid aluminum to the extent of about 1.5 per cent at the eutectic temperature. This solubility does not appear to play an important part in the present discussion, and the aluminum-rich solid solution for simplicity will be referred to as aluminum. The solubility of aluminum in solid silicon is not known but probably is slight, and does not appear to require consideration.

Binary aluminum-silicon alloys of general usefulness are those containing from about 5 to 15 per cent silicon. Throughout this range of composition the structure may be refined and the physical properties materially improved by the modifying process. However, both the degree of improvement and the actual properties reach a maximum, at about 13 per cent silicon. In commercial practice the modifying process is at present applied almost exclusively to alloys of approximately this silicon content. Structural changes brought about by modification are illustrated well in these alloys.

It has been discovered that the structural changes described may be brought about by causing the aluminum-silicon alloys to solidify rapidly, as by casting in an iron mold, without the use of sodium or any other modifying agent. In this case the phenomena evidently are due to undercooling. If the 13 per cent silicon alloy was undercooled equally with respect to both aluminum and silicon, then the solid alloy still would show primary silicon and eutectic, the undercooling merely causing refinement. The fact that primary silicon is replaced by primary aluminum shows that the crystallization of the silicon is suppressed by undercooling much more than is the crystallization of the aluminum.

Casting in a green-sand mold in sections of ordinary thickness does not cause sufficiently rapid freezing to produce modification. The sand-cast alloys may be modified by the special flux or alkali metal treatments, in which case the change is due essentially to the suppression of the crystallization of the silicon by the presence of metallic sodium in the metal at the time of solidification. The freezing point of the eutectic, normally at 577 degrees Cent., is lowered by modification, temperatures as low as 564 degrees Cent., having been recorded.

In alloys containing more than the eutectic proportion of silicon the temperature of separation of primary silicon from the melt is lowered by the presence of sodium and if the silicon content is not too great the crystallization of the primary silicon is suppressed entirely. These observations are based on cooling curves and mi-

Refine Structure

BINARY aluminum silicon alloys containing from 5 to 15 per cent silicon are the most useful. Throughout this range the structure may be refined and the physical properties improved by the modifying process. This process must be carried out in a particular manner and the authors of this article which is abstracted from a paper presented at the New York meeting of the American Institute of Mining and Metallurgical Engineers, describe the details of the operation. R. S. Archer and L. W. Kempf are associated with the research department of the Aluminum Co. of America, Cleveland.

croscopic examinations, methods which are limited in their sensitivity. It is probable that nuclei of primary silicon actually form at or near the normal temperatures, and that the apparent suppression is merely a retardation of crystal growth. On the other hand, in alloys containing less than the eutectic amount of silicon, the temperature of separation of the primary aluminum does not seem to be affected appreciably by the presence of sodium.

The mechanism by which a small quantity of sodium (less than 0.10 per cent) suppresses the crystallization of silicon is still a matter of speculation. Mention may be made of two views developed by the research staff of the Aluminum Co. of America. These may be referred to as the *colloid* theory and the *adsorption* theory. According to the first the sodium, which is only slightly soluble in molten aluminum, is present in the liquid aluminum-silicon alloy at the time of solidification in the form of vast numbers of liquid particles of colloidal size. These particles are considered as mechanically obstructing the growth of the silicon crystals in much the same way that particles of thoria obstruct grain growth in solid tungsten as shown by Jeffries and Archer, *Chemical & Metallurgical Engineering* 1922 No. 26. According to the other view, the growth of the silicon crystals is hindered by the adsorption of sodium, the silicon particles becoming partly or completely covered with films of sodium of atomic thickness.

Occurrence of Iron in Alloys

It is quite logical that the development of the silicon crystals should be impeded more effectively than that of the aluminum crystals by the presence of a given amount of sodium. A general rule is that the metallic elements crystallize more vigorously than the nonmetallic elements and metalloids like silicon. It even seems that the amount of sodium which produces the maximum refinement of silicon is just about the amount to produce germinative conditions with respect to aluminum and correspondingly large dendrite size. There also is a possibility that there is a selective attraction between sodium and silicon which is greater than that between aluminum and sodium. This is consistent with the fact that sodium is only slightly soluble in liquid aluminum.

Iron always is present in aluminum-silicon alloys as an impurity. It is practically insoluble in the solid state, and the presence of even a few hundredths per cent causes the appearance of a distinct *iron constituent*. In the alloys under consideration the iron constituent is generally in the form of plates, needles or perhaps flakes of irregular shape. These particles are refined somewhat by the modifying process.

The composition of the iron constituent in aluminum-silicon alloys is not known definitely. It is not the FeAl, of the binary aluminum-iron system, but is probably a ternary constituent containing iron, silicon and aluminum.

Loses Effect

With the introduction of his process, Pacz disclosed that if an aluminum-silicon alloy is allowed to stand in the molten condition for too long a time after the flux treatment, the modification effect gradually is lost, and that if a properly modified cast alloy is remelted and again cast without any further treatment, it reverts almost entirely to the normal condition. The discovery of the metallic-sodium method of modifying indicated that this reversion to the normal condition on standing in the molten state or on remelting is due to the loss of sodium. In fact there are visible signs of such loss. Subsequent experience has demonstrated as a practical certainty that the actual loss of sodium is the dominant factor in this reversion, although it is conceivable that there is some effect due to a change in the distribution of the sodium.

Reversion from the modified to the normal condition is gradual rather than abrupt. By pouring at various intervals of time after the proper execution of the fluxing treatment, it is possible to obtain castings varying continuously in structure and properties from the completely modified to the normal. Furthermore, it was recognized early that when insufficient quantities of flux are used, the castings obtained are only partly modified. The usual recommendations called for an amount of flux equal to about 3 per cent by weight of the metal treated. This flux contains two parts sodium fluoride to one part sodium chloride and is applied at about 927 degrees Cent. (1700 degrees Fahr.).

One of the first important results of the work leading to this paper was the establishment of the fact that poor modification results from the use of too much sodium as well as from too little sodium, whether the sodium be derived from the salt flux or added directly as metallic sodium. In fact, it is possible, by the use of too much sodium, to make the properties of the modified alloys inferior to those of the normal alloys.

For a long time after the discovery that the aluminum-silicon alloys may be modified by the addition of metallic sodium, it appeared somewhat doubtful that this method would give as good physical properties as the flux method. After trying both methods, several laboratories and foundries in various parts of the world concluded that the flux method gave better results, although the economy of the metallic sodium method was recognized universally. For this reason the flux method has been used by many in preference to the metallic-sodium method, in spite of the much greater economy of the latter.

The same conclusion seemed to be indicated by the first work in the laboratories of the Aluminum Co., but it was soon shown that the best results obtained by the flux method are no better than the best results obtained by the metallic-sodium method. It still seemed for some time that the flux method gave good results with greater uniformity and certainty than the metallic-sodium method, but after considerable experimentation, it was found possible to control the modifying process based on metallic sodium in such a way that the uniformity of results obtained both in laboratory and foundry fully equalled that obtained by the use of the flux. It now appears that the metallic-sodium method may be used almost exclusively in commercial practice. The following paragraphs detail the more important considerations involved in the successful operation of the process.

Quantity of Sodium Required

Probably the most important requirement for successful modification is that the molten alloy contain the proper amount of sodium well distributed at the time of casting. The amount of sodium required to produce the best results appears to be definite for a given alloy and for given casting conditions. The sodium requirement varies over a wide range with the composition of the alloy, particularly the silicon content, as will be shown subsequently. For a given alloy, the sodium requirement also varies with the rate of solidification, the general rule being that less sodium is required as the rate of solidification increases. The present discussion refers to test bars ½-inch in diameter poured from about 705 degrees Cent. (1300 degrees Fahr.) into green sand molds. The results may be considered applicable to the general run of sand castings having sections to about one inch thick. It is probable that some-

what larger quantities of sodium should be used where heavier sections predominate, but this factor not yet has been investigated systematically.

No simple and accurate method of determining the amount of sodium actually present in a modified casting has been developed. Such information would be interesting, but perhaps would not be of much practical use unless there also were some means of determining the sodium content of the molten alloy before casting. From the practical standpoint, the thing of interest is the quantity of sodium which must be added to the molten metal. If the conditions of the modifying process are kept constant, then the quantities of sodium present in the modified castings should be related definitely to the quantities added, although not necessarily directly proportional thereto. The amount of sodium in the metal at the time of casting will be determined by (1) the quantity added; (2) the efficiency of the addition; and (3) the loss before pouring into castings.

When it is considered that sodium and aluminum almost entirely are immiscible in the liquid state, that sodium is much lighter than aluminum, that it is highly inflammable and that its boiling point is in the range of ordinary melting temperatures for aluminum, it will be realized that it is no simple matter to make a quantitative addition of sodium to a molten aluminum-silicon alloy. It is beyond the scope of this paper to discuss the various methods that have been proposed or tried, and the discussion will be confined to one method which is simple and economical and has been found suitable for both laboratory and production work.

Method of Adding Sodium

The alloy is melted in a suitable crucible, pot or furnace, care being taken to avoid contamination with iron. A crucible or ladle from which the castings are to be poured is preheated to a red heat, say about 538-705 degrees Cent. (1000-1300 degrees Fahr.). The required quantity of sodium is weighed accurately and kept covered with kerosene until used. When the metal has reached a suitable temperature, which usually will be about 774 degrees Cent. (1425 degrees Fahr.), the sodium is placed in the bottom of the preheated pouring crucible or ladle. The molten metal then is poured immediately into this crucible in such a way as to stir the sodium into the aluminum as much as possible. This is ordinarily the only stirring employed.

Temperature of the metal at the time of pouring on to the sodium may be varied somewhat to suit the requirements of the foundry, but any such variation will affect the quantity of sodium to be used. The loss of sodium in this operation increases with the temperature of the metal, especially when this temperature exceeds about 802 degrees Cent. (1475 degrees Fahr.). The metal temperature should be controlled within 14 degrees Cent. (25 degrees Fahr.) for consistent results.

Loss of Sodium on Standing

The temperature of the preheated pouring crucible need not be controlled so closely, the temperature range given above being satisfactory. The object of preheating this crucible is to delay the subsequent cooling of the metal.

On throwing the sodium into the hot crucible, yellow flames will be observed. These are not due ordinarily to the combustion of sodium, but to the burning of the kerosene, which seems to protect the sodium for perhaps as much as a minute. The efficiency of sodium introduction by this method appears to be quite high, especially when the metal temperature is low.

It has been found advantageous to allow the molten alloy to stand quietly for some time after the addition of sodium. The function of this holding period partly is to allow the escape of the air and dross stirred into the metal with the sodium. However the benefits actually obtained seem too great to attribute entirely to this cleansing action. It is possible that during this period there is a diffusion of sodium through the alloy, and an escape of the larger particles of undissolved sodium by rising to the surface. Good modification has been obtained by adding a small amount of sodium and casting immediately afterward. However, it seems that maximum properties are obtained more consistently by adding an excess of sodium and allowing the metal to stand quietly for a certain period. It is recommended that this period be not less than five minutes, and better 10 to 20 minutes.

There is a continuous loss of sodium during the holding period, and the rate of this loss will vary obviously with conditions, such as the temperature of the metal and the size and shape of the container. It has been found, as would be expected, that the loss increases with the metal temperature, although no quantitative relations have been developed. The problem is one whose solution is made easier by the adoption of empirical rather than by any analytical methods.

Aluminum-silicon alloys possess certain advantageous properties which assure them an important place in the field of aluminum castings. Among these may be mentioned fluidity, freedom from hot shortness, freedom from leakage, and resistance to corrosion. The alloy compositions employed, the proportion used in the modified condition, and the methods of modifying will be determined eventually by extended commercial experience. A laboratory investigation can hope only to point out the possibilities and perhaps shorten the route to the final result. It is beyond the scope of this article to attempt a complete discussion of all factors which even now are known to have a bearing on the practical application of these experimental results. However, it is felt desirable to call attention to a few points which seem to the authors to be of special importance in connection with the modified alloys, and to outline a suggested method of approaching the modifying problem.

Most modified castings now are made of an alloy containing on the average about 12.75 per cent silicon. The selection of this composition seems to be based on a demand for the best combination of tensile strength and elongation. For many purposes, modified alloys of considerably lower silicon content probably would be more suitable, due to greater softness, plasticity, electrical conductivity, or other special property. That these alloys, in the modified condition, have been somewhat overlooked is perhaps due to lack of general knowledge that their properties may be improved so much by modification.

Maximum Properties

Greatest demand probably will continue to be for the maximum combination of strength and elongation; that is, for the properties characteristic of the alloys containing about 13 per cent silicon. It has been shown that both strength and elongation reach maximum values at or slightly below the composition of the modified eutectic, say at 13.25 to 14.0 per cent silicon. This does not mean, necessarily, that the adoption of this range of composition would insure maximum properties in commercial castings.

In the first place, it is commercially difficult to control composition within such close limits. It has been shown that as the silicon content exceeds the upper limit both strength and elongation fall off rapidly. A decrease of silicon content below the lower limit

mentioned causes a much more gradual decrease in strength and elongation. Therefore it is safer to work toward the lower side of the optimum silicon content.

Secondly, it is desirable to keep in mind the possible effects of imperfect modification. The properties of the normal alloys begin to decrease as the silicon content rises above 11 to 12 per cent and are distinctly inferior at 13.25 to 14.0 per cent. silicon. Therefore, the possibility of failing to obtain complete modification, indicates the use of less than the theoretical optimum silicon content. With good foundry control and perhaps with increased technical knowledge, it may prove desirable to attempt to take advantage of the superior properties of the alloys with compositions close to that of the modified eutectic.

Experiments Fix Process Details

The fact that the amount of sodium required to produce maximum properties varies with the silicon content and perhaps with other characteristics of the alloy indicates the desirability of basing commercial production of modified castings on large lots of uniform alloy. Having obtained a large quantity of suitable material, a few preliminary experiments may be carried out to fix the details of the modifying process in accordance with conditions in the foundry and, perhaps, the requirements of the particular job to be run.

Suppose the castings to be made are such that a pouring temperature of 693 degrees Cent. (1280 degrees Fahr.) is suitable, and that the size of the castings and the foundry equipment indicate a pouring crucible or ladle of 100-pound capacity. The temperature of the metal at the time of adding sodium and the temperature to which the pouring crucible is preheated then may be determined by experiment so that the metal will reach the desired pouring temperature in 5 to 25 (preferably 10 to 20) minutes, remembering that it is desirable to keep the modifying temperature under about 788 degrees Cent. (1450 degrees Fahr.). Suppose it is found that with a modifying temperature of 760 degrees Cent. (1400 degrees Fahr.) and with the pouring crucible preheated to a dull red, the metal cools to the right pouring temperature in about 12 minutes. A few experiments with various amounts of sodium will indicate the best quantity to use under the conditions adopted. An attempt should then be made in regular practice to adhere as closely as possible to all details of the procedure thus determined. With a little experience, it often is possible to tell from the fracture of the metal whether it is properly modified, undermodified (too little sodium) or overmodified (too much sodium).

The modifying process is discussed in detail and some suggestions are made for the practical operation of this process.

The more important results are summarized in the following statements:

Metallic sodium produces as good and as uniform modification as the salt flux, and is distinctly more economical.

The chief requirement for good modification is that the molten alloy contain a certain definite amount of sodium at the moment of casting. Larger or smaller amounts give inferior results.

The amount of sodium required for modification varies with the silicon content, and perhaps with other characteristics, of the alloy to be modified. The amount of sodium added to produce good modification, under the specific conditions here employed, varies from about 0.01 per cent for an alloy containing less than 1 per cent silicon to about 0.10 per cent for an alloy containing 14.0 per cent silicon.

The tensile strength of the normal alloys increases with silicon content from 12,800 pounds per square inch for the aluminum ingot used to about 22,000 pounds per square inch at the composition of the normal eutectic (11 to 12 per cent silicon), and then decreases rapidly with further additions of silicon. This applies to alloys containing 0.35 per cent iron.

Elongation Decreases

The elongation of the normal alloys decreases rapidly from 25 per cent for the ingot to 10 per cent at about 2 per cent silicon, then more slowly as the silicon increases. There is apparently a slight maximum of about 5 to 6 per cent elongation at the composition of the normal eutectic. Further additions of silicon cause the elongation to decrease rapidly to less than 2 per cent at 14 per cent silicon.

For all compositions both strength and elongation are improved by modification.

The tensile strength of the modified alloys (0.35 per cent iron) increases with silicon content to a maximum of 27,000 to 28,000 pounds per square inch at the composition of the modified eutectic (14 per cent silicon) then decreases with further additions of silicon.

The elongation of the modified alloys decreases from 28 per cent for the ingot to about 13 per cent at 1.5 per cent silicon, remains nearly constant to about 12 per cent silicon, rises slightly at the composition of the modified eutectic (14 per cent silicon), and then falls rapidly with higher amounts of silicon.

The addition of iron above 0.35 per cent to the modified alloys decreases elongation.

The addition of iron above 0.35 per cent to the modified alloys containing 11 to 14 per cent silicon increases tensile strength up to about 0.75 per cent iron; further additions of iron decrease tensile strength as well as elongation.

The alloy compositions which give the maximum properties when properly modified are not necessarily those which will consistently give the best average results in commercial practice.

EquipmentManufacturers Hold Meeting

One of the principal features of the spring meeting of the Foundry Equipment Manufacturers association which was held at Cambridge Springs, Pa., April 21 and 22, was an address by R. L. Lockwood, national committee on metals utilization, department of commerce, Washington, entitled "What a Simplification Program Could Accomplish for Manufacturers of Foundry Equipment." Mr. Lockwood's remarks led to considerable discussion and to the passage of a resolution authorizing the president of the association to appoint a committee to investigate possibilities of effecting savings in manufacture through simplification and standardization in the foundry equipment industry. S. C. Vessy, W. W. Sly Mfg. Co., Cleveland, was made chairman of this committee. He will be assisted by N. S. Lawrence, Whiting Corp,, Harvey, Ill. and R. T. Turner, Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.

E. F. DuBrul, general manager, National Machine Tool Builders association, Cincinnati, outlined some of the work which this organization has accomplished for its members. Mr. DuBrul pointed to the recently adopted standard milling machine spindle end as an example of what manufacturers may accomplish by group action.

Reports on business conditions discussed at the meeting indicated that sales were fully as satisfactory during the first quarter of this year as in 1926. An elaborate and interesting report on sales methods and policies was presented by J. S. Sammons, Beardsley & Piper Co., Chicago.

Fig 1.—Measuring Metal Temperature in the Foundry Using a Stationary Indicator

Designs Fire End for Determining Brass Pouring Temperature

By A. A. Grubb, L. H. Marshall and C. V. Nass

IN THE the manufacture of small brass castings there are at least two distinct points at which the temperature may be measured; first in the melting furnace, second, in the pouring ladle. While furnace temperature is important, tests and experience have indicated that the temperature of the metal entering the mold is even more vital.

In the endeavor to develop a more satisfactory means for measuring the temperature many different instruments and thermocouples were investigated. The thermoelectric pyrometer system with a millivoltmeter indicator was adhered to in general, as being the most practical apparatus for use in the hands of unskilled labor under foundry conditions. Open end couples with various refractory coatings, a number of different kinds of protecting tubes, and other means suggested by pyrometer manufacturers were tried out in seeking a more reliable method for temperature measurement.

A protection tube that would not introduce too great a lag in the temperature readings and still have a reasonable life in service seemed an obvious way out of the difficulty. Work was inaugurated accordingly with that in mind. It was found that ferroalloys of high chromium content offered quite remarkable resistance to the attack of molten brass. Consequently such alloys were used for the thermocouple tips described here.

Two qualifications had to be met to secure a quick reading couple. First, the mass of the protection tube must be as small as possible. Second, there should be the minimum of thermal insulation between the hot junction of the thermocouple and the molten metal. The use of a thin protection tube, which would form one element of the thermocouple, suggested itself as a means of meeting these requirements. An insulated wire leading through the center of the tube and welded to its closed end would serve as the other element of the thermocouple. This equipment was made and found to work. However, it was discovered that small counter electromotive forces were developed, due probably to differences in temperature of the surface and interior of the molten metal, that made the temperature readings uncertain by 20 or 30 degress Fahr.

Supply Melting Data

This is the second section of a paper presented at the symposium on Temperature Determination in the Nonferrous Foundry held at the Detroit convention of the American Foundrymen's association. Mr. Grubb, Mr. Marshall and Mr. Nass are director of laboratories, research metallurgist and plant metallurgist, respectively of the Ohio Brass Co., Mansfield, O. Mr. Clarke is connected with the alloy foundry, General Electric Co., Erie, Pa.

To overcome this difficulty it was necessary to use the two-wire couple and have the outer tube serve as a protection means only. The single wire trial had shown that quick readings could be secured in that way; probably because the hot-junction was directly in contact with the molten metal. It was decided, therefore, to keep this feature in the two-wire modification. Such a couple with minor improvements is the type now in use, for which patents have been applied for.

Fig. 3 shows a longitudinal section of the thermocouple tip now in use. It will be seen that the piece consists essentially of the chromium alloy protecting tube *A*, in which is inserted the two-hole refractory insulator *B*. The 16-gage chromel-alumel thermocouple wires *C* pass through this insulator to the small end of the protection tube, where they enter a smaller hole in the end of the tip. These thermocouple wires, at the tip, have been flattened out with a die so that each forms a half circle and together they just fit the hole in the tip of the protection tube. This tip is then swayed down against the wires, preferably by means of a die, thus clamping the wires together and closing any opening through which the molten metal might enter. Better results have been obtained with such a junction than were secured either by twisting the wires or welding them at the tip.

The thermocouple then is mounted in a handle which consists of about two feet of 22-gage, ⅝-inch diameter, seamless steel tubing with a wooden hand grip. The protection tip is fastened into one end of the seamless tube by means of the two screws shown in Fig. 3. The thermocouple wires, previously strung with refractory insulators, lead through the tube to the wooden hand grip shown in Fig. 4. The cap has been removed from this piece to show the method of connecting the wires. The thermocouple wires *C* are fastened to the brass strips *D* by means of screws. These brass connectors are attached permanently to the wooden handle and have the chromel-alumel lead wires *E* soldered to them. The lead wires *E* go either to the indicator or to the cold junction box. The spring coil on the end of the handle serves to protect these lead wires from severe bending at that point. Fig. 2 is a photograph of the complete assembly connected to a portable indicator.

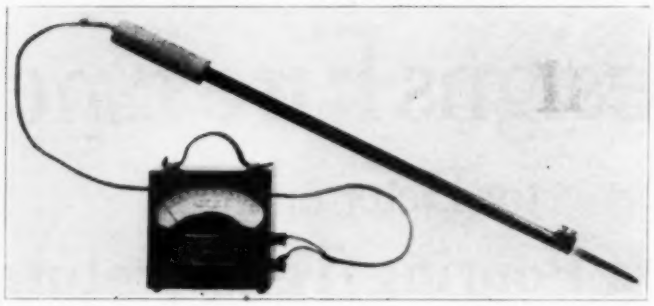


Fig. 2—Assembled Thermocouple with Portable Indicator

As has been stated, the thermocouple is in direct contact with the protection tip. This contact cuts the time required to reach temperature and does not interfere with the accuracy of the reading, since the thermocouple otherwise is insulated completely from the protection tube and the circuit consequently is not completed. In practice a protection tip and thermocouple are assembled and kept in reserve. When the tip in use burns through, it is replaced readily by the spare part. This is accomplished by merely loosening the two screws that hold the protection tip in the end of the steel tube and unfastening the thermocouple wires from the brass connecting strips in the handle. The worn out tip and couple are then taken out and the new unit slipped in and fastened with a minimum of delay.

Having described the construction of the thermocouple, a few notes on its use will be included. It may be connected to either a portable or a stationary indicator. A permanent installation of a high-resistance, millivoltimeter-type indicator, mounted on a rigid support, has proved satisfactory. Such a set-up necessitates routing the ladles of metal to the pyrometer station, but that scheme has worked better than carrying the portable indicator to the pots. An added convenience can be secured with the high resistance indicator by having two thermocouples connected to the instrument through a double throw switch so that a spare couple is always at hand. Fig. 1 shows a stationary indicator unit in use in the brass foundry.

In practice the thermocouple is immersed in the molten metal for about three inches, stirring constantly with the tip. Moving it in this way cuts the time required to reach the metal temperature by about three seconds. The indicator pointer is watched and as soon as it comes to rest the reading is made. It requires around 20 seconds for the thermocouple to come to temperature from a cold start. This interval increases but slightly with use. After each immersion the hot tip is wiped gently on a wire brush to remove the adhering slag. Care must be exercised at this point not to break the tip, as it is relatively fragile at the high temperatures. For the same reason, the thermocouple should be so supported when not in use that there will be no chance for its weight to rest on the tip.

Experience has demonstrated the serviceability of this thermocouple. Records of the tips used in the foundry show that with red brass, poured at 2000 to 2150 degrees Fahr., the average life of the tip is more than 800 immersions. When the pot temperature reaches 2300 degrees Fahr. however, the life of the tip is quite short; nor will it resist the action of phosphor bronze. On the other hand, trial runs in copper, yellow brass, and aluminum bronze have indicated the practicability of its use with these metals.

Judges Temperatures Visually

By R. R. Clarke

DIFFERENT metals and alloys vary sharply in color manifestations and no well defined or uniform standard of comparison can be taken by which to judge them. That all metals and alloys whiten toward sunlight with advancing temperature is about the nearest to a general rule that can be stated. Some metals proceed from red to white, some from yellow to white, some from red to yellow to white. Therefore, it is clear that in judging by color each metal and alloy is a law unto itself and must be known in its details of peculiarity in order to exercise intelligent judgment on it. As a matter of illustration, a few common metals and alloys will be discussed, as follows:

Copper: Copper appears dull red at low liquid temperature and proceeds to a bluish white with temperature. Free of oxides at high temperature it is beautifully clear and limpid.

Aluminum: Aluminum in shadow appears white at low temperature, advances to red at higher temperature and assumes a pale orange white at extreme temperature.

Copper, 85—*Tin*, 5—*Lead*, 5—*Zinc*, 5: This metal proceeds with increasing temperature from a reddish yellow to a yellowish white, interspersed with a bluish tint. This bluish tint occurs at temperatures where the zinc

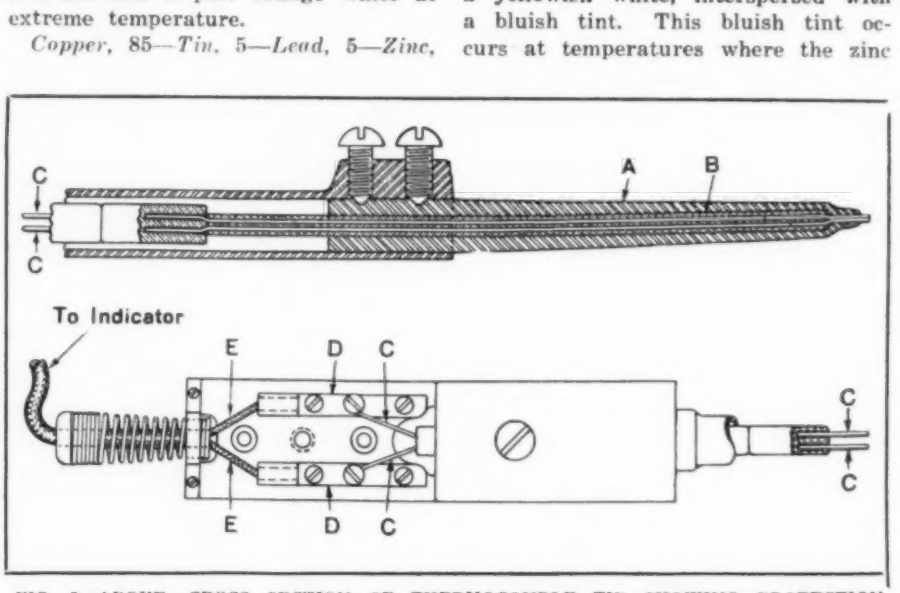


FIG. 3—ABOVE, CROSS SECTION OF THERMOCOUPLE TIP SHOWING PROTECTION TUBE, REFRACTORY INSULATOR AND WIRES. FIG. 4—BELOW, THERMOCOUPLE HANDLE WITH SECTION REMOVED TO INDICATE METHOD OF CONNECTING

volatilizes, giving the zinc-volatilizing color.

Copper, 88—*Tin*, 10—*Zinc*, 2: This mixture is reddish yellow at low temperatures, yellowish white at high, "waved" with brilliant tints of blue and purple and gold. These elaborating tints derive from the tin content, which exhibits these distinctions at high temperatures.

Copper, 80—*Tin*, 10—*Lead*, 10—*Phosphorus, traces:* This alloy is blood red at low temperature advancing to white with rising temperature.

Copper, 70—*Zinc*, 30: This metal is dull yellow at low temperature, yellowish white at high temperature, flaring with brilliant bluish yellowish tints that are caused by the volatilizing zinc.

Fluidity Factor

Regarding these different manifestations as stated, it might be noted that they represent those appearing in reflected sunlight, or in ordinary daylight shade. When the shade becomes abnormal, as on a dark day, the color varies perceptibly toward a lighter effect. Thus, different alloys appearing red on a bright, clear day will appear white at the same temperature on a dark, cloudy day. Another distinction to be observed is metal in daylight and metal at night in artificial light. The difference in appearance often leads to bad errors of judgment if not known and observed. In total darkness all metals and alloys of high fusing temperature take on a greater whiteness and brilliancy.

Fluidity in its varying degrees is a consequence of temperature, and, to a well developed and finely discriminating sense constitutes a safe and stable indication of temperature; viscosity of metal is therefore the real and decisive test, the most nearly scientific test to which judgment can address its determining powers. It is freely used by some molders and as freely neglected by others, the difference representing largely natural aptitude along with prevalent practice at the time of learning the trade.

Viscosity can be determined both by sight and by feeling and the two taken together afford a check against each other by which the condition of the metal can be quite accurately judged. The hotter the metal, the more fluid: the colder, the more viscous, makes up the fundamental principle of the system. Fluid metal as against viscous metal exhibits many distinctions plainly marked. It looks thinner, its surface lies flatter, it hugs the walls of the crucible closer, it displaces more easily, its dross and impurities ride higher, easier, the freer the surfaces; a solid immersed in it meets much less resistance, it flows faster, easier, cleaner. It adheres to congealing walls less tenaciously, etc. These and various other exhibitions can be discerned either by sight or feeling or both and the relative temperatures they indicate may be judged by them. The end of a skimmer bar pushed over a metal surface will indicate the viscosity of the metal by the resistance it meets, as will the behavior of the liquid metal coming to rest following the disturbance.

Close study and experience, along with an appreciation of different specific gravities of different metals and alloys, are essential to enlightened application of the viscosity test and are ever to be reckoned with in connection with it. One of the first tests on the alloy copper, 80—tin, 10—lead, 10—phosphorus, trace, the author learned, was to immerse a skimmer bar in the metal bath, hold it there a second and withdraw it. When the metal dripped off the drawn skimmer like buttermilk, it was ready to pour that particular casting.

As a general rule, cold metal by its viscous appearance to sight engages the intuition of experience as to its coldness. To first glance it appears numb, lifeless, and molders often intuitively remark, "It has a dead look." When a metal, an alloy, or some ingredient of the alloy, has reached its boiling point, an iron skimmer bar immersed in the bath will record the agitation of boiling to the sense of feeling in the nature of a clicking or crackling sensation. This phenomenon is quite in evidence in the high zinc-copper alloys and is frequently used as a basis of judgment in high temperatures of those alloys.

Action of Metal in Sprues

If a bar of solid metal free from protective coating be immersed in a bath of kindred metal at high temperature, the solid metal will melt and disappear rapidly. It the metal bath be lower in temperature the bar will melt and disappear proportionately more slowly. This furnishes the basis for another observation test on metal temperature.

When hot metal comes to rest in a sprue head, the time consumed by the metal in this head to completely solidify is quite extended. If coming to rest at a lower temperature, the solidifying period is shortened perceptibly. From this it is possible to derive a good check on temperature by observing the sprue head of a mold poured first among a number of molds to be poured from the same pot of metal.

By the hydrostatic principles, the static pressure of liquid metal in a filled sprue advances with the fluidity of the metal. If a sprue be filled with hot metal, the metal after filling the sprue will sink down in the sprue much farther than will colder metal. This may often indicate a severe swelling or sand-burning of the casting from too hot metal.

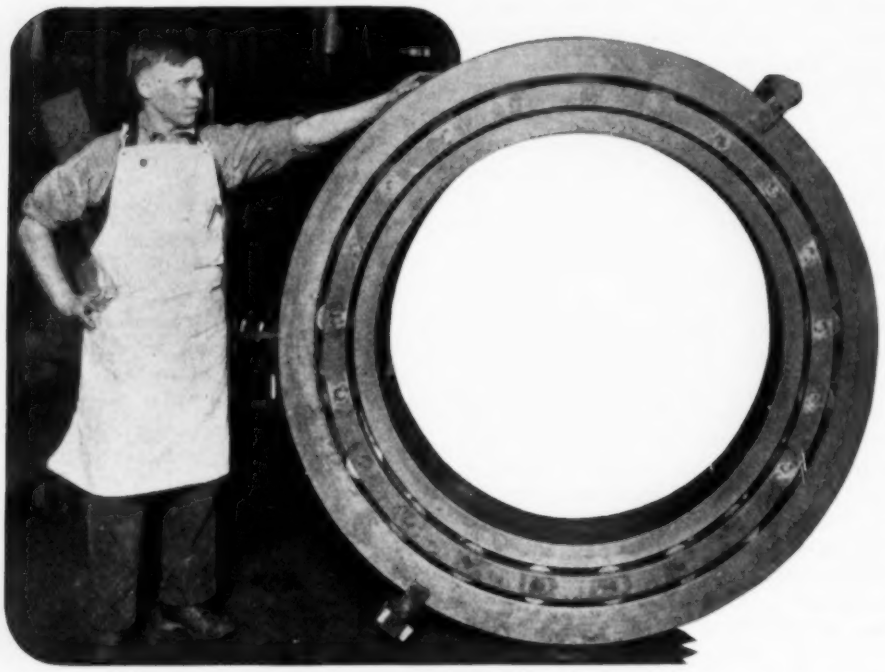
In his molding days, the author always prepared his first two molds for pouring especially for hot metal. He would then bring his metal on the warm side of these molds, pour them and note the time it took the sprue head to solidify, as well as the depth of descent of the metal in the sprue. This furnished a basis for one of the safest and best tests and corrections on metal temperature to which in all his experience, he ever resorted.

Reduces Oxide Surface

Alloys without phosphorus usually present a rather viscous and misleading surface appearance, due to the oxide film occasioned by the atmosphere on that surface. By viscosity the metal therefore appears colder than it really is. If a little phosphorus be added, as is often done, the metal at once looks relatively hotter than it really is, in that the elimination of the oxide film reveals the metal in its actual under-mass state. This thinner appearance of a metal surface when phosphorus is added is sometimes erroneously assumed to indicate that the phosphorus raised the temperature of the metal. The proposition will not demonstrate and practice completely disproves the assumption. The most the phosphorus does is to clarify the surface by reducing the oxide scum, giving the surface metal a thinner, clearer appearance. The same appearance will exhibit under a layer of charcoal over the surface metal. Under extreme temperature, many metals and alloys become so oxidized as to appear lumpy, granular, thickened, viscous, etc. In this state of oxidation they are lumpy, granular, etc., just as they appear to be, but the condition is due to *excess* of temperature rather than *lack* of it.

When a filled sprue in solidifying swells up instead of shrinks down, the indication is that the metal is suffering from included gases and oxides and suggests either bad furnace practice or too high temperature in pouring the metal into the molds.

Roller Bearing Weighs Two Tons



THE largest bearings ever built by the Timken Roller Bearing Co., Canton, O., have just been completed and shipped, according to officials of the company. These bearings have a bore of 42 inches and an outside diameter of 61 9/16 inches. At 30 revolutions per minute these bearings have a capacity of 2,750,000 pounds. The weight of each bearing is more than 2 tons.

The bearings will be installed by the Allis-Chalmers Mfg. Co. in the largest compeb mill in the world. This will be put in service in a plant manufacturing portland cement. This mill is 10¾ feet diameter and 45 feet long and is used to take the clinker from the cement kiln and grind it to finished cement in one machine to the desired degree of fineness.

The advantages of the roller bearing in this machine will be the material reduction of the overall length of the machine, since the width of the bearings is only 13¼ inches. Likewise, the bearings may be adequately enclosed, which will obviate the necessity of renewing the lubricant supply except at infrequent intervals. The tapered construction of the bearing permits the carrying of all loads, regardless of direction without the use of thrust plates or special bearings.

International Congress To Be Held

A special committee consisting of T. D. Lynch, chairman, P. H. Bates, T. G. Delbridge, Zay Jeffries and G. W. Thompson has been appointed by the American Society for Testing Materials to plan for American participation at the International Congress for Testing Materials to be held Sept. 12 to 17 at Amsterdam, Holland. This committee has secured offers of 24 papers from members of the society upon topics announced for discussion at the congress. Three of the papers are of a general nature, 11 relate to the field of metals, 4 to cement and concrete, and 6 to a group of miscellaneous materials. Several of the authors have indicated their expectation of attending the congress and presenting their papers in persons.

Reduced Railroad Rates for Chicago Convention

All passenger associations for the United States and Canada with the exception of the Canadian Passenger association (Western lines) have granted reduced rates for the Chicago convention on the same plan as used for the 1925 and 1926 conventions. Round trip tickets will be sold at one and one-half fare for the round trip to holders of an identification certificate which only can be secured through the secretary of the American Foundrymen's association. Reduced rates are applicable for members and dependent members of their families only. Tickets will be good via route in both directions only. Tickets will be sold from June 2 to June 8, with a final return limit midnight June 16. Nonmembers may receive certificates by sending in applications for membership, or presenting a receipt for one way fare from the ticket agent with an application for membership to the secretary of the American Foundrymen's association immediately after arrival at convention headquarters.

Refractories Institute To Hold Meeting

The annual spring meeting of the American Refractories institute will be held at Hotel Traymore, Atlantic City, N. J., on May 18 and 19. Technical sessions will be held on May 18 followed by a dinner in the evening, May 19 will be devoted to a golf tournament. Papers to be presented are: "Research in the Refractories Industry," by M. C. Booze, Charles Taylor Sons Co., Cincinnati; "Properties of Clay Refractories Resulting from the Control of Grain Size in Flint Clay," refractories fellowship paper, Mellon institute, Pittsburgh; "Some Characteristics of Fire Clays and Brick Made from Them," by R. F. Geller, bureau of standards, Washington; "The Effect of the Use of Purite upon Refractories," by G. S. Evans, Mathieson Alkali Works, Chicago. A discussion of numerous questions on the industry and technical problems encountered also will be held.

A.F.A. Creates Committee

A general American Foundrymen's association committee has been appointed by S. W. Utley, president, to study the prevention of waste in the foundry industry. Sub-committees have been formed for each branch of the industry with chairmen as follow: Steel, Carl S. Koch, president, Fort Pitt Steel Casting Co., McKeesport, Pa.; Malleable, L. C. Wilson, vice president, Federal Malleable Co., West Allis, Wis.; Gray Iron, Fred Erb, president, Erb-Joyce Foundry Co., Detroit; Nonferrous, L. W. Olson, factory manager, Ohio Brass Co., Mansfield, O.

W. Scott Thomas, 303 National Exchange Bank building, Providence, R. I., has been appointed district representative by the Shanafelt Mfg. Co., Canton, O., for its steel flasks.

Nickel Changes Properties of Gray Cast Iron-I

By D. M. Houston

CAST iron is made up of varying percentages of iron, carbon, manganese, silicon, sulphur and phosphorus. The properties or characteristics—hardness, chilling tendency, structure, etc., depend largely upon these percentages, particularly those of carbon, silicon and sulphur, as well as upon the rate of cooling of the casting.

When molten cast metal is poured into a sand mold, the metal is cooled by its contact with the mold, and due to the rapid absorption of heat by the sand, the outside sections of the casting are chilled. The chill reflects itself in a thin white iron skin or scale wherever it has come in contact with the sand, and just beyond the white iron skin there is an area chilled less but the effects of chilling are shown by the carbide inclusions. Micrographs in Fig. 1 show the structure just under the skin, ⅛-inch and ¾-inch under the skin.

These carbide inclusions or hard spots decrease from edge to center in the same way as the rate of cooling diminishes so that we have the probability of many different types of iron in different parts of the same casting, even though the iron is cast from the same ladle.

Chemical analyses and the microscope reveal that variation of combined carbon is responsible for this condition. We agree that high combined carbon makes cast iron hard and it is its variation from one part of a casting to another that many of our most troublesome difficulties may be ascribed. If we can control the combined carbon in cast iron and distribute it evenly from surface to center, we shall have done much toward reaching our ideal for cast iron.

The steps we take to reduce combined carbon in gray iron are precisely those which promote graphitization: Keep total carbon high; keep sulphur in proper ratio to manganese; cool slowly. All of these factors must be kept in mind and balanced properly in producing a casting of proper characteristics and of proper combined carbon. Balancing is sometimes a most difficult matter.

It is obvious that if a casting is to be used commercially it must be strong and sound and readily machinable; not only in one portion but in all, whether of thick or thin section. A mixture which produces a satisfactory amount of combined carbon in a given section of the casting, such that this section is not hard to machine and has a satisfactory structure, may not be satisfactory in sections either much thinner or much thicker. If we are limited to this one mixture, we find ourselves in a dilemma, one horn of which is a hard casting, machinable with difficulty, and the other, a readily machinable product but open-grained and weak. Many foundries partially meet this situation by using several mixtures, but how are we to meet it when the same casting has both heavy and thin sections?

In this case we should have to use a low silicon iron for the heavy section and a high silicon iron for the light one. If we compromise we shall have too soft a mixture for the heavy section and showing internal shrink and shall have hard edges in the light section. There is one solution to the problem. Find an element that will make it possible to distribute the combined carbon evenly from edge to center of the casting.

Explains Effect

MACHINE hardness, wear resistance and denseness of cast iron are factors that must be considered in automotive and other machine castings. The use of nickel in the gray iron foundry has passed the experimental stage. It is being used commercially to a great extent to effect changes in the characteristics of cast iron. In this article which will be presented in two sections, the author explains the effect and use of nickel. Mr. Houston is foundry engineer, development and research department, International Nickel Co., New York.

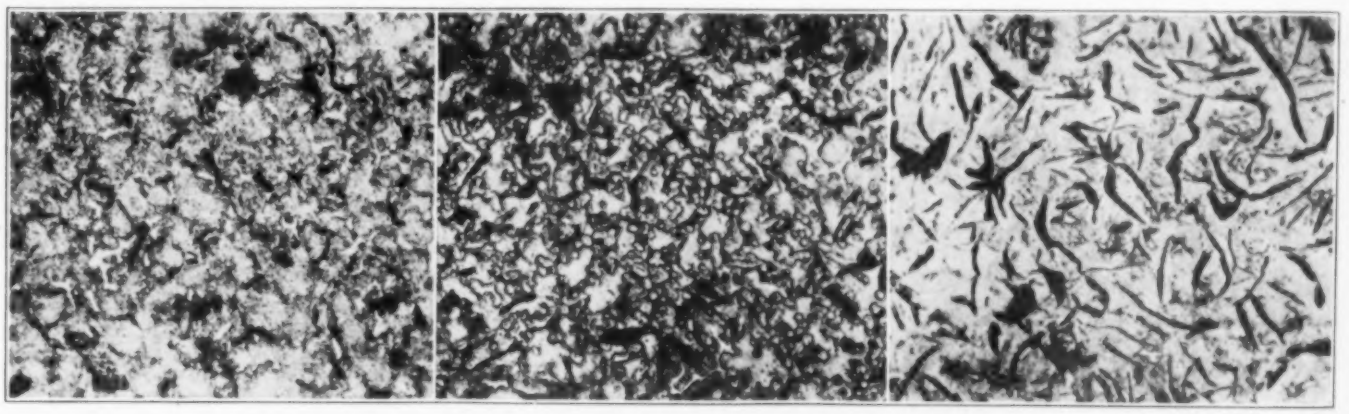


FIG. 1—MICROGRAPHS SHOWING THE STRUCTURE OF CAST IRON. LEFT TO RIGHT, JUST UNDER THE SKIN; ¼-INCH UNDER SKIN; ¾-INCH UNDER THE SKIN. ALL AT 100 DIAMETERS

Table I

Mixture for Steam Pump Casting

MIXTURE NO. 1

Material:	Pounds	Si.	S.	P.	Mn	Ni.	TC	Price per lb.	Total Cost:
Foundry scrap	350	1.75	0.08	0.31	0.70	.....	3.35	0.008	2.80
Pig Iron	650	1.91	0.032	0.52	0.78	.....	.....	0.0124	8.06
Final analysis	1000	1.85	0.08	0.51	0.71	.....	3.35	.....	10.86
MIXTURE NO. 2									
Steel scrap	300	0.20	0.02	0.04	0.45	.....	.....	0.0055	1.65
Foundry scrap	600	2.20	0.09	0.50	0.55	.....	3.40	0.008	4.80
Pig iron	100	1.91	0.032	0.52	0.78	.....	.....	0.0124	1.24
Nickel shot	7½	.....	.....	.....	.....	.....	.....	0.36	2.70
Final analysis	1000	1.57	0.120	0.36	0.51	0.75	3.30	.....	10.39

Nickel is a carbide softener and a matrix hardener. It controls and restrains chill and formation of excess combined carbon. At the same time it hardens the iron matrix of the casting without detriment to machinability.

This action of nickel has an application in overcoming internal shrinkage, because it permits a metallurgist to formulate a mixture in which the silicon content is sufficiently low to overcome internal shrinkage. At the same time it will break down hard iron formations in corners, edges and thin sections, because of its graphitizing value and that it does not promote internal shrinkage. In this way, nickel is a softener and supplements silicon. It has been demonstrated that gray cast iron by the use of nickel may be made machinable with virtually no silicon present and contain only nodular graphite.

Again, we find that nickel does not materially precipitate graphite below the upper critical range, but rather reverses its action and definitely restricts the breaking up of combined carbon and at the same time serves as a hardener and a toughener of the matrix of the metal. This is especially true in irons containing above 2 per cent of silicon and 0.5 per cent or more of nickel. The combined carbon is increased as the nickel content is increased.

Fig. 2 shows the effect of this restraining action of nickel on graphitization with increasing percentages of nickel used in iron of same anaylsis.

The influence which nickel exerts in this range is not proportionate to the amount of other metals present, but directly to the nickel content itself. As the nickel content is increased above 2 per cent to approximately 8 per cent the brinell hardness values are raised consistently, so that irrespective of the amount of silicon present, nickel within the per cents mentioned overpowers the effects of carbon and silicon, partly due to restraining effect on graphitization and partly to the toughening of the matrix.

It is clear from the foregoing that nickel and silicon in cast iron function much in the same manner in their relation to carbon. While this is true as far as the influence of the two elements on graphitization is concerned, there is a distinct difference in the form of graphite which is precipitated. This, as mentioned previously, virtually stops at the upper critical range, or about 1800 degrees Fahr. While silicon seems to function definitely in the breaking down of carbides, its action is much more sensitive to rapid cooling. Consequently, the carbides are not broken down completely or necessarily even when a low percentage of combined carbon is present. This is illustrated well in the micrographs in Figs. 3 and 5. The presence of carbides is shown in a 2.2 per cent silicon ordinary piston iron while the lower silicon iron with nickel is free from carbides. In the plain iron, carbides persist even though the silicon content is high and only a small amount of combined carbon is present.

The action of nickel in breaking down carbides is much more definite. However, the breaking down or dissolving action of carbides by nickel stops just below the carbon eutectoid.

Table II

Change To Use Cheaper Iron

MIXTURE NO. 3
Plain Iron

Material:	Pounds	Si.	S.	P.	Mn	Ni.	TC	Price per lb.	Cost:
Steel scrap	150	0.20	0.04	0.04	0.45	.....	.....	0.011	1.65
Foundry scrap	350	2.40	0.09	0.32	0.60	.....	.....	0.009	3.15
Pig iron	350	2.25	0.029	0.48	0.67	.....	.....	0.0116	4.06
Pig iron (Spec.)	150	5.62	0.019	0.37	0.49	.....	.....	0.017	2.55
Final analysis	1000	2.41	0.089	0.36	0.58	.....	3.38	.....	11.41
MIXTURE NO. 4									
		Off-Iron	with	Nickel					
Foundry scrap	500	2.40	0.122	0.27	0.49	.....	.....	0.009	4.50
Pig Iron (Off)	500	2.17	0.09	0.21	0.43	.....	.....	0.009	4.50
Nickel	6	.....	.....	.....	.....	.....	.....	0.36	2.16
Final analysis	1000	2.27	0.141	0.27	0.48	0.61	3.58	.....	11.16

This accounts for the ease of machining irons containing only sufficient nickel to break up these formations. These conditions make it desirable to use nickel to supplement silicon.

Silicon content in any gray iron foundry mixture should be such that the combined carbon in heavy sections of high grade castings be between 0.50 and 0.70 per cent. This percentage guarantees a strong, solid casting. Nickel should be added to

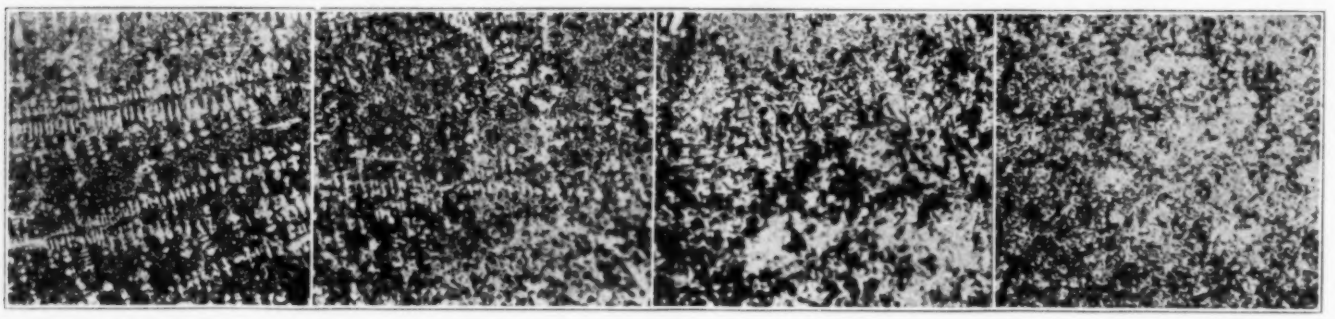


FIG. 2—SHOWING THE EFFECT OF NICKEL ADDITIONS. LEFT TO RIGHT, 0 PER CENT; 0.5 PER CENT; 1.5 PER CENT; AND 2.5 PER CENT NICKEL. ALL MICROGRAPHS AT 100 DIAMETERS

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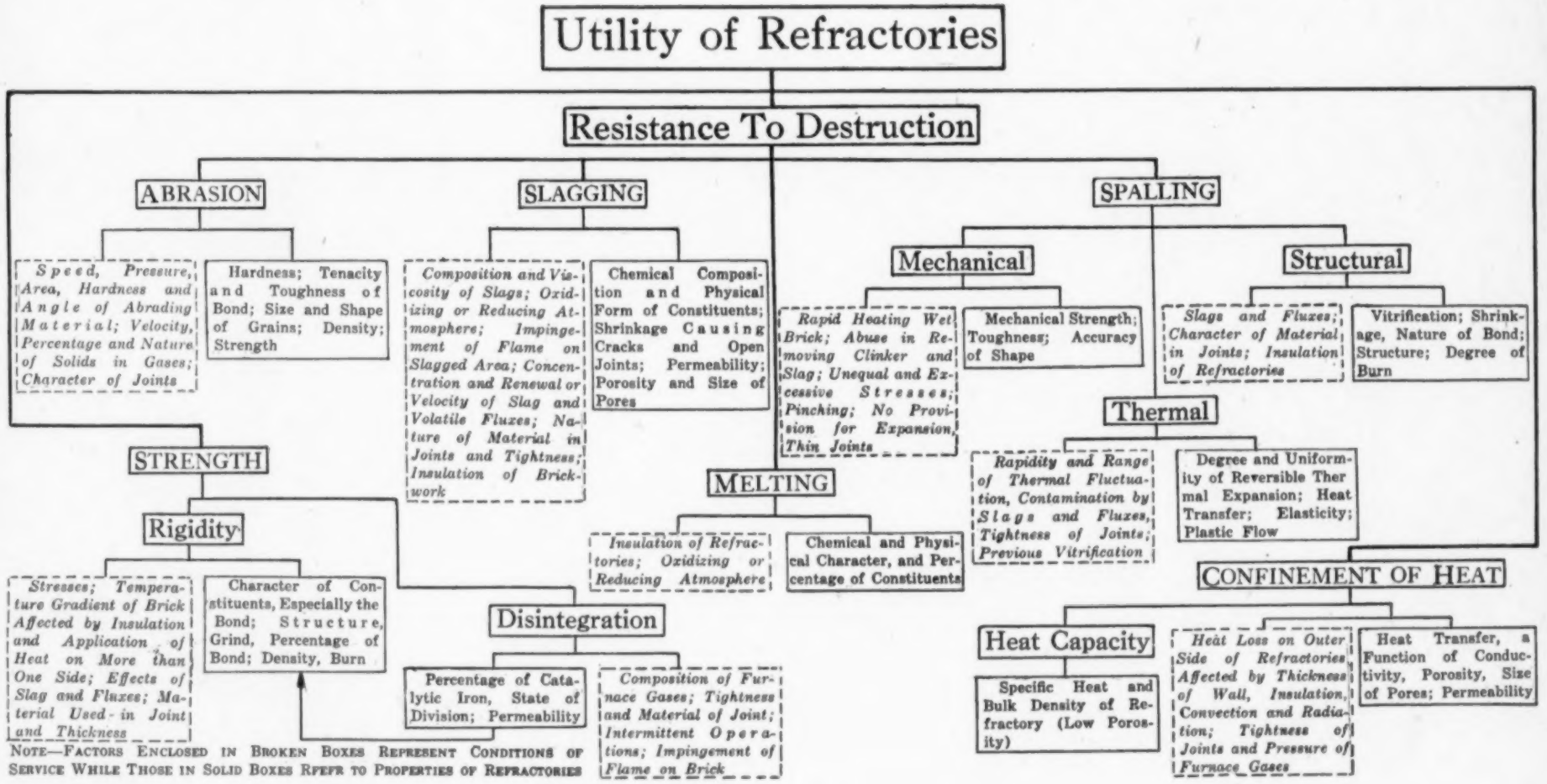
FACTORS AFFECTING REFRACTORIES


Utility of Refractories
Resistance To Destruction
ABRASION
Speed, Pressure, Area, Hardness and Angle of Abrading Material; Velocity, Percentage and Nature of Solids in Gases; Character of Joints
Hardness; Tenacity and Toughness of Bond; Size and Shape of Grains; Density; Strength
SLAGGING
Composition and Viscosity of Slags; Oxidizing or Reducing Atmosphere; Impingement of Flame on Slagged Area; Concentration and Renewal or Velocity of Slag and Volatile Fluxes; Nature of Material in Joints and Tightness; Insulation of Brickwork
Chemical Composition and Physical Form of Constituents; Shrinkage Causing Cracks and Open Joints; Permeability; Porosity and Size of Pores
SPALLING
Mechanical
Rapid Heating Wet Brick; Abuse in Removing Clinker and Slag; Unequal and Excessive Stresses; Pinching; No Provision for Expansion, Thin Joints
Mechanical Strength; Toughness; Accuracy of Shape
Structural
Slags and Fluxes; Character of Material in Joints; Insulation of Refractories
Vitrification; Shrinkage, Nature of Bond; Structure; Degree of Burn
Thermal
Rapidity and Range of Thermal Fluctuation, Contamination by Slags and Fluxes, Tightness of Joints; Previous Vitrification
Degree and Uniformity of Reversible Thermal Expansion; Heat Transfer; Elasticity; Plastic Flow
STRENGTH
Rigidity
Stresses; Temperature Gradient of Brick Affected by Insulation and Application of Heat on More than One Side; Effects of Slag and Fluxes; Material Used in Joint and Thickness
Character of Constituents, Especially the Bond; Structure, Grind, Percentage of Bond; Density, Burn
MELTING
Insulation of Refractories; Oxidizing or Reducing Atmosphere
Chemical and Physical Character, and Percentage of Constituents
Disintegration
Percentage of Catalytic Iron, State of Division; Permeability
Composition of Furnace Gases; Tightness and Material of Joint; Intermittent Operations; Impingement of Flame on Brick
CONFINEMENT OF HEAT
Heat Capacity
Specific Heat and Bulk Density of Refractory (Low Porosity)
Heat Loss on Outer Side of Refractories Affected by Thickness of Wall, Insulation, Convection and Radiation; Tightness of Joints and Pressure of Furnace Gases
Heat Transfer, a Function of Conductivity, Porosity, Size of Pores; Permeability

NOTE—FACTORS ENCLOSED IN BROKEN BOXES REPRESENT CONDITIONS OF SERVICE WHILE THOSE IN SOLID BOXES REFER TO PROPERTIES OF REFRACTORIES

Most of the factors of service and properties of refractories given in this chart are interdependent and are affected greatly in degree by the functions of temperature and time. Factors in the chart are believed to cover the more common conditions encountered and naturally vary in degree depending upon the type of service in question. This chart was developed by the American Refractories institute, Pittsburgh.

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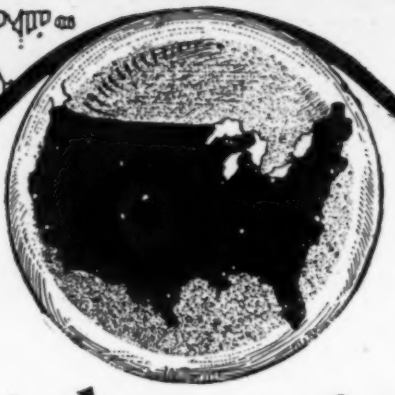
Note—This sheet may be cut along this line and one half folded over the other to bind in a 5 x 7 note book.

THE FOUNDRY DATA SHEET, MAY 15, 1927
Payment will be made for all contributions on foundry and pattern shop practice suitable for publication



Seeing America with The Foundry

Little Journeys to the homes of our readers

ILLINOIS has a total of 467 foundries of which

297 Melt Gray Iron
26 Melt Steel
28 Make Malleable Iron
140 Are Exclusive Brass
109 Have Nonferrous Departments, and
187 Melt Aluminum

ILLINOIS, the state which sent Lincoln from her courtrooms and legislative halls to become President at a time of the Nation's greatest trial, stands third in the Union in the extent and importance of manufacture. Cheap fuel and unusual transportation facilities are responsible for this standing.

The state has a total area of about 56,000 square miles and within the borders of this territory has a total of more than 12,000 miles of railway lines, being excelled in this respect only by Texas. Practically all the main transportation arteries of the country pass through or have their terminals in Illinois.

Standing as the gateway between the agricultural West and the markets of the East, it is natural that the manufacture of agricultural implements, iron and steel products, clothing, and flour and grist mill products should predominate in the roll call of commodities made. The great iron and steel mills center in the northern section of the state, around Chicago and the borders of Lake Michigan to the north and south. The Quad Cities, embracing Moline, Rock Island and East Moline, with Davenport across the Mississippi, have extensive factories making implements and farm machinery, trucks and automobiles.

The Mississippi bounding the west, the Ohio on the south and east and Lake Michigan at the northeast corner all provide exceptional water transportation facilities to supplement the railways in which Illinois abounds.

In ILLINOIS—THE FOUNDRY has 770 paid subscribers

"Wherever metals are cast you'll find THE FOUNDRY"

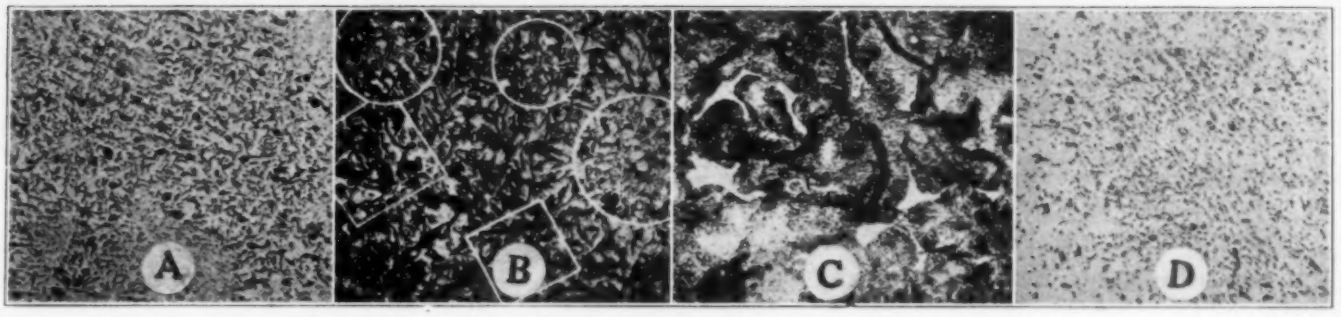


FIG. 3—*A*, ORDINARY GRAY CAST IRON SHOWING COARSE GRAPHITE X 50. *B*, SAME AS *A* X 150. GRAPHITE-FERRITE CONCRETIONS IN CIRCLE, IRON CARBIDE KNOTS IN SQUARES. *C*, SAME AS *A* X 500, WHITE AREAS ARE CEMENTITE. *D*, 0.5 PER CENT NICKEL ADDED, SHOWING FINER STRUCTURE, X 50

the mixture in sufficient percentages to break down the carbide formations on edges, corners and in thin sections. The amount of nickel necessary to supplement the desired silicon is calculated according to the formula: Two of nickel equals one of silicon.

As intimated, the use of nickel in cast iron must reflect itself in economic values. If a material is needed requiring only bulk and weight and little, if any, machine work, the use of nickel is not recommended, unless use of nickel would make possible the melting of a cheaper mixture than another made from other suitable materials. In castings requiring uniformity of structure in various sections, uniform strength and considerable machining, it is worth while to look into the possibilities of a nickel-iron mixture. Two mixtures illustrating how the selection and manipulation of materials to reduce the cost of the mixture and improve the quality of metal used for making steam pump castings are given in Table I.

It will be seen from Table I that in these particular mixtures, both scrap and steel are cheap and advantage was taken of this condition.

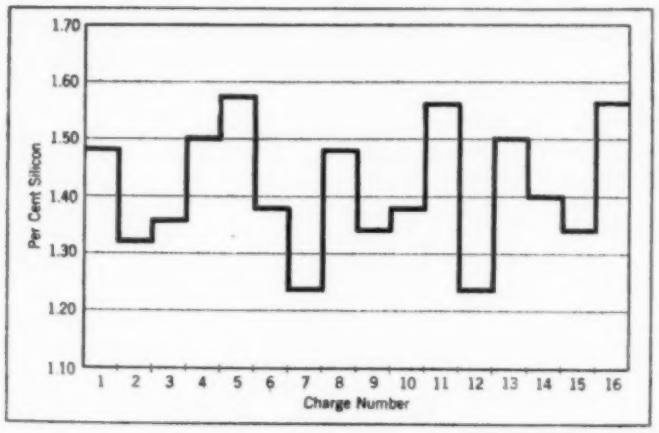


Fig. 4 — Chart Showing Variation in Silicon Content of Cupola Cast Iron from Successive Charges

The mixtures given in Table II were cheapened by the use of off-iron, in another locality in which off-iron was obtained easily and cheaply.

It will be noted from both of the nickel-iron mixtures that the sulphur content practically has been disregarded. This is due to the fact that the toughening effect of nickel on the matrix of the metal overcomes the embrittling effect of high sulphur. Sulphur is one of the elements, if out of ratio with manganese, that restrains graphite precipitation. Thereby, it gives a closer grain and stronger iron than one with a lower sulphur content. It also gives results similar to small percentages of chromium in sections less than 1½ inches. Many users anneal their gray iron castings to secure uniform hardness or if you please, softness. Annealing for this purpose destroys many of the desirable characteristics of gray iron. Regardless of this and the time and expense involved; production requirements, expensive tool equipment and the use of automatic machines sometimes make this process necessary.

The author has pointed out the stabilizing effect of nickel on combined carbon related to casting conditions, but the variation of the metalloids from the calculated amounts due to the heterogeneous nature of the charge and to the fact that cupola charges do not melt down always uniformly as charged is even more important. Carbon and silicon are subject to variations as shown in the chart presented in Fig. 4.

From 0.5 to 0.75 per cent nickel has been found to overcome both variations of cupola and casting conditions and the effect of these additions will be described in the second part of this article.

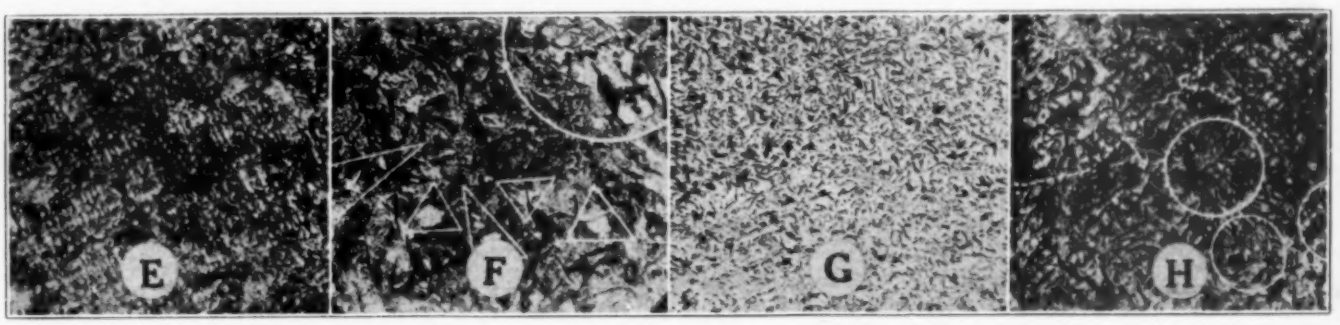


FIG. 5—*E*, SAME AS 3 *D*, X 150, SMALL WHITE PARTICLES ARE FERRITE *F*, SAME AS *E*, X 500, SMALL ISLANDS OF FERRITE IN TRIANGLES IN PEARLITIC-SORBITIC MATRIX. *G*, HIGH SILICON IRON WITHOUT NICKEL, X 50, SHOWING HEAVY GRAPHITE PRECIPITATION. *H*, SAME AS *G*, X 150, FERRITE-GRAPHITE CONCRETIONS IN CIRCLE IN PEARLITIC MATRIX CUT BY LONG GRAPHITE FLAKES

How and Why in Brass Founding

By Charles Vickers

Brass Must Be Hard

We have a demand for white brass castings which must be hard and tough. While we have experimented we have not been able to secure a good formula. We could make a white brass of sufficient hardness and toughness by using expensive ingredients but inasmuch as price is an object, it is imperative that we use cheaper materials.

The name *white brass* covers a multitude of alloys varying in composition, but the real white brass as known in the United States is an alloy containing over 60 per cent of tin. For marine work, where it is used largely, we doubt whether there is any substitute, cheap or expensive.

We suggest that you use the following alloy: Zinc 85 per cent; copper 10 per cent; aluminum 5 per cent. This makes a strong alloy, as strong as brass in tensile. However, it is not tough, that is it will not stretch in the tensile machine.

What Is Monel Metal?

Will you please give us information about monel metal? We want to know what the mixture is and the temperature of melting and pouring for green sand molding.

Monel metal is an alloy of nickel with copper, iron and other metals. The analysis will vary a little with the service the alloy is intended for, but a fairly representative mixture for casting purposes may contain: Nickel, 67 per cent; copper, 28 per cent; iron 3.5 per cent; silicon 1 per cent; sulphur, carbon, and manganese 0.50 per cent. It would not be advisable to attempt to make the alloy like a bronze, but the ingot metal should be purchased from the original makers. Scrap monel can be purchased, but as it is difficult to separate it from scrap steel, and even if free therefrom, the composition might not be adapted for casting purposes. It is not advisable for a foundryman inexperienced with the alloy to buy such material.

The melting point of monel metal is around 2480 degrees Fahr., and its pouring temperature must be considerably higher than that. It may be melted in any good oil-fired crucible furnace and be poured into castings in green sand molds. The sand should be free and open and contain a larger percentage of silica than ordinary brass molding sands. The metal when molten should be deoxidized before it is poured and some makers prefer to do this with magnesium. It is necessary, to see that the deoxidizer is thoroughly incorporated with the metal. The tensile strength of monel as cast will be around 70,000, pounds per square inch with between 20 and 30 per cent elongation.

Dross Causes Trouble

We are sending you a plug casting made from a formula containing copper, 89 per cent; aluminum, 10 per cent and iron, 1 per cent. You will note there is considerable dross in the casting which is exposed by the machining. Can you advise us in regard to the method of gating to keep the dross out of the casting? Also should a special flux be used to obtain better castings?

The method of gating for aluminum bronze is important, not only to *keep out* dross but *to prevent* its formation within the mold cavity. Just imagine you are filling a glass mold like this plug mold with soap suds and it is necessary to fill it with the clear liquid with not a trace of foam. It is evident the liquid must be flowed in without velocity or jet effect, because such movement would produce foam inside the mold. Also it will be evident the mold should be inclined so the liquid flows uphill. The sprues and runners should be made so that the liquid does not drop far, consequently the plug must be gated on the small end.

Plan to have a long runner to convey the stream to the bottom end of the mold, and then allow it to rise into the mold cavity. At the other end place a heavy riser; one riser to each casting. In making the alloy, melt the copper carefully to keep oxidation down and use charcoal. Add the iron to the molten copper, then a little aluminum and superheat to bring out the alumina formed. Then add the remainder of the aluminum, and 0.5 per cent flux to bring the oxides and drosses to the surface.

MixingPhosphorusBronze

Can you inform us if the word phosphor bronze as used in the term phosphor bronze is a contraction of the word phosphorus? Also is there a trace of phosphorus in all bronze, and if so how large a percentage ought there be to entitle it to be known as phosphor bronze.

The word *phosphor* is a contraction of the word phosphorus, just as aluminum is a contraction of the word aluminium. Thus we use the words phosphor bronze; phosphor copper and phosphor tin and everybody understands what is meant. There are no hard and fast rules as to the amount of phosphorus an alloy must contain to be entitled to the name of phosphor bronze. This name sometimes is applied in cases where only traces of phosphorus, from deoxidation, are found.

Phosphorus additions seldom are made to yellow brass alloys, although there is no scientific reason why such additions should not be made. Little red metal or bronze is made into castings without the addition of traces of phosphorus as a deoxidizer. Bell metals should be free of it as it impairs the tone of the bells; iron being the proper deoxidizer in this case. As a yellow brass containing a trace of manganese is know as manganese bronze there is a precedent for calling any copper tin or copper tin zinc and lead alloy with traces of phosphorus, a phosphor bronze, but strictly speaking they should not be so termed. A division might be made at 0.15 per cent addition of phosphorus as that means the addition of 1 per cent of 15 per cent phosphor copper and it is enough for many alloys. Phosphor bronze might also be divided into two kinds; one a high tensile alloy minus lead; the other a bearing alloy containing 10 per cent or more lead. A fine example of the former class of alloys is copper 90 per cent, tin 5 per cent, 5 per cent phosphor tin 5 per cent. This alloy has 0.25 per cent phosphorus added and is a true phosphor bronze, easy to cast while alloys with 1 per cent or more phosphorus are difficult to cast. Specifications of leaded bearing alloys frequently call for 0.8 to 1 per cent phosphorus, which is too high as it makes them difficult to cast and to machine.

What Causes Common Defects in CASTINGS?

By John W. Bolton

EDITOR'S NOTE—*This is the second article by Mr. Bolton outlining causes of various defects in castings. The first of the series of two articles appeared in the May 1 issue.*

Fig. 8—What Defects Will Appear After Cleaning?

SHRINKAGE is defined by Webster as synonymous with contraction, or withdrawal, the latter being a better definition for this discussion. Shrinkage is a misunderstood and misapplied term with many foundrymen. When the shrinkage of cast iron is compared with shrinkage of bronze or aluminum, the contraction of the metal on cooling from the molten state to the room temperature is considered. Since the metal shortens or contracts when it cools, the patternmaker uses a shrink rule to allow for the change in section and to produce a casting of the desired dimensions.

Shrinkage defect has an entirely different meaning. The term indicates a defect which has resulted from the withdrawal of the metal while in the liquid or plastic state. Therefore, a shrinkage defect is a cavity, either minute or large which has resulted from differential crystallization and varying rates of contraction. A shrinkage defect is a jagged hole or spongy area. The interior of the hole is lined with tiny fern like crystals which metallographists call dendrites. The crystals have the same color as a fresh fracture unless they have been discolored by gases which have worked their way into the metal.

A review of the method in which gray iron crystallizes should give an accurate conception of a shrinkage defect and its formation. Gray iron crystallizes over a range of temperature or in other words it does not set immediately, but passes through a pasty stage in which the metal is part solid and part liquid. The first crystals that separate out are comparatively low in carbon, and the remaining liquid, therefore, is richer in that element. These primary crystals or dendrites gradually grow larger in layers and each succeeding layer is richer in carbon, as may be noted in Fig. 9. Finally at the eutectic (ledeburite) temperature the residual material solidifies.

If through some agency the liquid portion of a partially solidified metal containing dendritic crystals could be drained off, a jagged cavity bounded by fernlike dendrites would result. The cavity is nothing more than a shrink cavity produced intentionally. Where shrink cavities appear in castings, the metal may have been pulled away by gravity and contraction, as shown in Fig. 10, or by contraction alone.

May Be Avoided

Several simple ways for avoiding shrinkage cavities may be followed. One of the most common causes of shrinkage defects is unequal section sizes. This is a fault of design which may result disastrously. Defects of the type described may be eliminated or at least minimized by feeding the casting properly. Ferrostatic pressure, acting through the semiplastic mass, pushes the crystals together. Feeding to eliminate shrinkage usually is accomplished by using risers, as shown in Fig. 11. The riser must be designed to solidify last, otherwise the riser will pull metal away from the casting. Chills also may be used near the heavier sections or where hot spots may appear. Thus the heavier sections and the thinner sections may be cooled in the same length of time, and the cooling gradients promoting shrinkage eliminated. In some cases pouring the metal at a higher temperature will eliminate shrinkage. This will cause the sand of the mold to dry before much solidification sets in and will promote more equal cooling conditions throughout the casting.

Shrinkage defects are more likely to occur in metals having a high contraction. Steel castings, for example, are more subject to shrinkage than iron castings. Low carbon and low silicon iron castings are more likely to show shrinkage defects than iron castings having a higher percentage of carbon and silicon. Gray irons show much less contraction than steel because graphite carbon is formed in the gray iron. The change of carbon from dissolved cementite into graphite flakes and austentite involves an increase in volume. Thus any combination causing formation of more graphitic carbon will minimize shrinkage. Unfortunately, excess of graphitic carbon weakens the metal, so that this remedy should be applied with discretion. Improper design is the more common fault and wherever possible the design should be changed rather than sacrifice the quality of the metal to overcome the defect.

A peculiar shrink sometimes is found which closely resembles both a blowhole and a shrinkage cavity. In this type of defect the cavity is jagged similar to a shrinkage defect. It usually is colored a yellow or a blue which distinguishes it from the fracture color of the blind shrink. Careful examination usually reveals some small passage leading to the outside of the casting. In such cases it is evident that the gas forced its way in after the dendrite formation had commenced, or conversely had not escaped until crystallization had commenced.

Castings Become Scabby

Scabbing is caused by a portion of the mold surface being washed away and the cavity filled with metal, as shown in Fig. 12. If the scabbed portion of the mold floats intact, some part of the casting will be hollowed out, as shown in the illustration. Often the fragment of the mold breaks up and the sand grains are found throughout the metal. Wash-

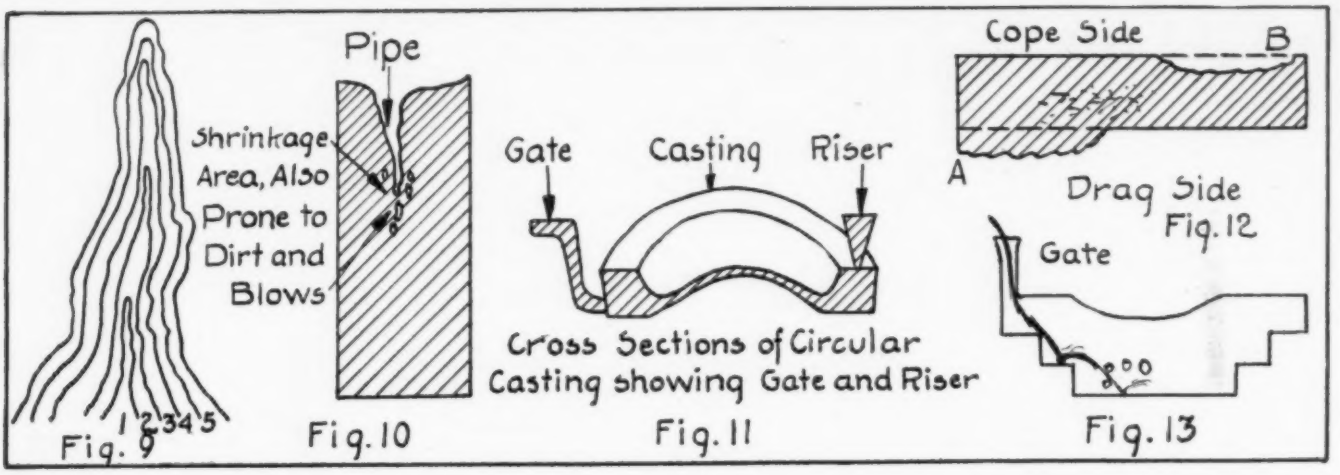


FIG. 9—EACH LAYER HAS A SLIGHTLY DIFFERENT CARBON CONTENT. FIG. 10—SECTION OF CYLINDRICAL CASTING SHOWING SHRINKAGE. FIG. 11—RISERS ARE USED TO PREVENT SHRINKAGE. FIG. 12—SAND OF THE MOLD MAY FLOAT AWAY AND CAUSE A SCAB. FIG. 13—THE IRON SHOULD NOT SPATTER WHEN IT FLOWS INTO THE MOLD

ing and scabbing are terms sometimes used synonymously. However, a scab indicates that a portion of the sand mold has floated away while a wash shows a defect only skin deep. Cuts is another term of similar significance.

Scabs, cuts and washes arise from similar sources. Wild iron boiling in the ladle may tear up the mold. Impermeable sand, too much water, hard cores or too heavy ramming may keep the iron from lying quietly when poured into the mold cavity. The action of the metal and the generation of gas may cause sections of the mold to break away or the surface of the mold to wash.

Improper gating also is responsible in many cases for washes and cuts. If the metal drops some distance and strikes the surface of the mold, or where the velocity of the metal in the mold is high, some of the sand may be washed and will be distributed throughout the metal.

Small or large particles of metal, similar to shot, sometimes are found imbedded in the metal. Often the shot are chilled and are entirely separate from the remainder of the metal in the casting. The shot inclusions are formed when the metal is caused to spatter as it strikes the surface of the mold as shown in Fig. 13. Such a condition arises from careless pouring, improper gating and wet molds.

A crack or rupture in a casting indicates that a force or stress acted on the casting. Such stresses may be either internal or external. All castings are subject to some internal stress which improperly are termed strains. These stresses result from normal forces of crystallization and contraction, from internal arrangements within the metal and from inequal rates of expression and contraction between the various parts of the casting. The crystallization at a square and a round corner is shown in Fig. 15.

The force which sets up stresses may be understood by considering an ordinary cylindrical casting. The outer surfaces of the casting naturally cool more rapidly than the inner or central section. The cooling causes the outer surfaces to contract more

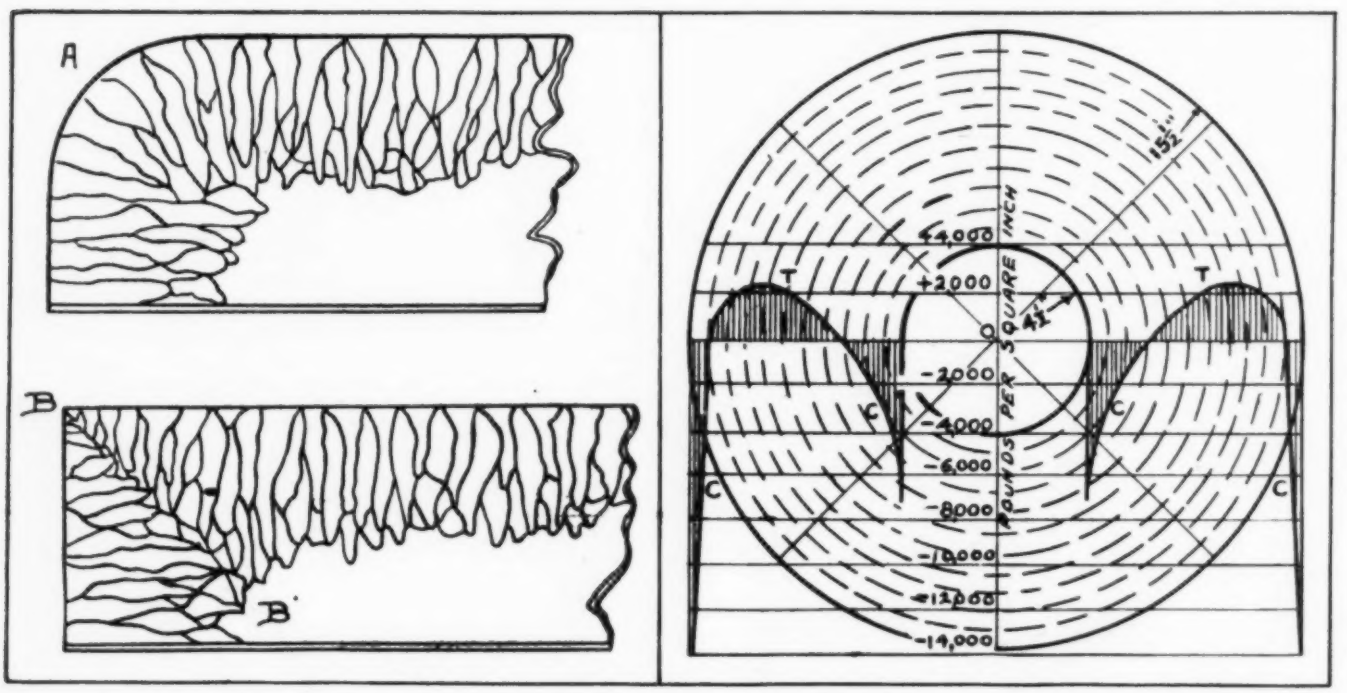


FIG. 14—CRYSTALLIZATION EFFECT AT A ROUND AND A SQUARE CORNER. FIG. 15 SHOWING THE SHRINKAGE STRESSES IN A CAST IRON CANNON ACCORDING TO J. B. JOHNSON

which results in tension of the two outer rings and compression in the center of the casting. The shrinkage stresses have been studied in the case of cast iron guns and one such analysis is shown in Fig. 15. The metal was over 11 inches in thickness. The outer and the inner surfaces cooled first and the shrinkage of the interior put those parts in compression. The diagram was drawn and computed by the late J. B. Johnson.

Sharp corners are undesirable in foundry practice since they sometimes are responsible for crack formations. The undesirable crystalline formation at sharp corners and the unfavorable distribution of isothermal lines is shown in Fig. 14. Sharp corners also are undesirable from the viewpoint of resistance to mechanical stresses, for heat treatment, and in some instances from the viewpoint of avoiding shrinkage defects.

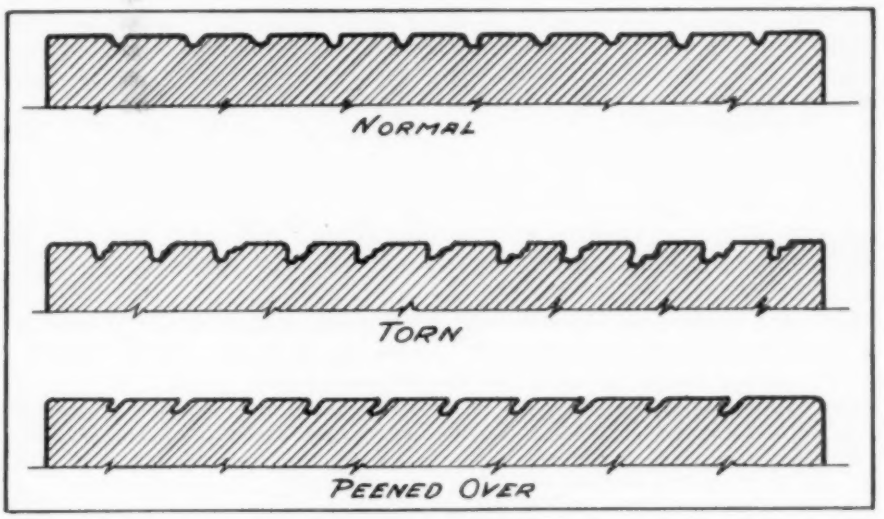


FIG. 16—THE NORMAL CASTING WITH THE PITTED SURFACE IS SHOWN ABOVE, THE TEARING EFFECT OF HEAVY MACHINING IN THE CENTER AND THE PEENING EFFECT OF GRINDING OR SEVERAL LIGHT CUTS IN THE LOWER ILLUSTRATION

Speaking generally, conditions which promote graphitization lessen contraction, so that castings with a high total carbon and low combined carbon should be less likely to crack in the casting operation. High test irons have greater contraction and therefore require greater care in design and in casting.

External stresses are outside forces. These may be due to the setup of the mold, handling of the casting, machine shop operations or during the actual service of the finished casting. Unyielding cores also are common causes of cracks in cylindrical castings. In other cases hard ramming, incorrect use of rods, spiders, etc., may cause trouble.

Carelessness in breaking off gates, improper packing when tumbling and similar errors may cause cracks, particularly in castings which already have internal stresses. Machining operations always set up severe surface stresses and unless the castings are clamped and supported properly, the machining operations also set up general stresses. Often these stresses crack the castings. Cracks formed by machining either are bright fractures or the they may be darkened by the action of moisture, heat, oil and similar causes. The cracks rarely are reddish like those formed when the casting is cooling in the foundry. Quick heating or cooling of the casting in normalizing or heat treating may cause cracks.

It has been shown repeatedly that iron with good physical properties can be produced uniformly. Unfortunately many gray iron castings are poured of poor quality metal. This may be due to ignorance of methods of producing good metal or the lack of painstaking effort. As a result gray iron has been held in disrepute by many engineers. Faulty design and absurd demands for machinability further have encouraged the manufacture of poorer grades of iron. Research and the wider dissemination of information leave no excuse for ignorance of proper production methods. The idea must be sold that certain grades of iron give better service than others.

Good iron for light jobs can be made with 35,000 to 45,000 pounds per square inch tensile strength and over, while in heavier sections 30,000 to 35,000 pounds per square inch tensile strength easily is possible. However, many castings are made having only half of this strength. Strength is governed largely by the silicon and the carbon content of the metal. In many foundries silicon is held too high and no real carbon control is exercised.

Convenience has caused the use of transverse test bars by foundrymen, although such bars mean little to the average engineer, who is accustomed to express the strength in pounds per square inch. No accurate method has been determined to transfer the usual transverse test into tensile figures. A good compromise may be found in the modulus or rupture, figure, since in this method all bars are figured on the same basis. Good metal should run well in excess of 50,000 pounds transverse modulus of rupture.

Recent research has determined that good quality gray iron has a high fatigue value. It will deflect considerably before fracture, may be peened with a hammer and in some operations chips will curl up somewhat like steel. Where service requirements demand, gray iron should be sold on definite physical specifications.

Open grain iron is due to the presence of large, coarse graphite flakes and causes pits or small openings on a machined surface. Open grain is undesirable where strength and wear are important and where a smooth surface is necessary. The large graphite flakes indicate either too high silicon or too high total carbon or both.

While open grained irons always are undesirable where strength, toughness and good appearance are demanded, good appearance not always is an indication of these qualities. Certain machine operations, such as grinding, tend to close the most open grained metal. Thus a better grade of metal poorly finished may not appear as good as poor iron with its open grains closed over on the surface.

Issue 1926 Transactions

Volume 34 of the Transactions of the American Foundrymen's association, containing the reports and papers issued during 1926 recently has been published. The volume consists of 1200 pages and is the largest single volume ever issued by the association. The price is $8.

The Philadelphia district offices of the Combustion Engineering Corp., Heine Boiler Co. and the Ladd Water Tube Boiler Co., have been consolidated at 607 Bankers Trust building, Philadelphia.

Bill Makes Casting For a Superheater

By Pat Dwyer

NATIVES of India and Africa have a tradition that no person ever has seen a dead elephant. Reference of course is made to the wild elephant who recognizes no master, who roams through the jungle or the forest at his own sweet will during the period of a more or less long and happy life, and then disappears.

According to our best sources of information, the natives claim that when this wily and exceedingly sagacious animal realizes that the sands of life are running low, he heads away for a secret place never seen by the eye of man and there curls up and dies.

Well, maybe he stretches out before crossing his front feet on his leathery chest. By the way what do you call his pedal extremities? Are they feet or paws or hoofs? I must look that up some time.

Fiction writers on many occasions have seized on this well known tradition and built up thrilling romances dealing with the adventures of the go-get-'em boys who found the elephant cemetery and acquired a fabulous fortune from the sale of the mountain of ivory.

Perhaps the elephants disappear into this little hiding hole and perhaps they do not. Personally, I think the story is what the boys call a bit of hooey. An elephant, living or dead is no fairy. In nautical parlance, loaded down to the plimsol mark and drawing about 10 feet fore and aft, his displacement is about equal to that of a small steam tugboat.

Unless the natives of India and Africa are totally devoid of the sense of smell I cannot understand how the hiding place of a few hundred dead elephants possibly could remain a secret.

One of our modern dicks with a nose constantly on the alert smelling a rat, could find the place blindfolded and with both hands in his pockets. The highly developed nose of a dry agent would lead him to the place the day after he landed in the country. With the breeze in a favorable direction one of our famous modern dramatists standing on Table Head could locate the spot though it lay beyond the Congo. Among English-speaking molders and perhaps in other circles for all I know, there is a tradition that no person ever saw a dead donkey or a dead hobo molder. Why the two should be coupled never has been explained satisfactorily, but let that pass for the moment. I do not know what the experience of others has been; but speaking simply for myself, I must admit that I never have seen either one or the other. I have seen lots of them living, but so far as I know, they invariably creep into a hole at the end of the trail and then pull the hole in after them. I don't pretend to be able to explain this mysterious phenomenon. The heathen Chinee has no monopoly on ways that are dark and tricks that are vain.

The foregoing train of thought was started in my mind the other day after I had read an account of the passing of John G. Adams, better known to thousands of molders all over the country as Cigaret Jack. Without doubt he was the most widely traveled member of a fraternity that is notorious for its rambling propensities. Members of the ancient craft without number have toured America. Limitations of language have kept most of the European members in their own countries, but even at that their itching feet have carried them far and wide. Brave Jack has been everywhere. To slightly paraphase the slogan of THE FOUNDRY "Whenever metals are cast Jack has been Johnny on the spot."

CIGARETS SHORTENED HIS LIFE

He was on the road for nearly 50 years and in that time he worked in foundries in North, South and Central America, in Australia, New Zealand and the Philippine Islands. He worked in every country in Europe, in China, Japan and the Straits Settlement. He hobnobbed with the Moors in Morocco and Algeria and with the descendants of the Pharaohs in the ancient land of Egypt. His wandering feet carried him to Capetown, to Kimberly and Johannesburgh where he made castings for the roaring stamp mills that day and night keep the earth in a tremble while crushing the gold laden quartz from the deeps of the great gold reefs of the African Rand.

He never was sick a day in his life, although warned on innumerable occasions that his habit of incessantly smoking cigarets would carry him off before his time. About 20 years ago, a mere kid of 67, he blew into Pittsburgh and the change of air or the smoke or something affected his lungs. A doctor advised him he was all in and he had better cancel any further tours he had in mind.

Jack accepted the verdict philosophically and got himself a nice little job in a hospital where there was not much to do and where he could pass away in peace when the time arrived. He did not last long. Only a trifle of about 20 years. The insidious cigaret finally finished him. If he only had taken the doctor's advice and given up the filthy habit, he might have lived to a ripe old age instead of passing out as you might say in his prime at the comparatively early age of 87. Without doubt also, the rambling life he led for so many years before he finally settled down may have been a con-

tributory factor in his peculiar case.

When Bill came in the other night I showed him the item about Jack. Bill is a firm believer in the old foundry tradition that molders never die. They just disappear. The evidence in this case, I said, clearly proved that at least one molder had passed out in the orthodox manner and further he had been buried in style with bell, book and candle and with all the prominent members of the Molders' union attending the funeral.

"Well," said he, "I'll tell you. That is only one exception to prove the rule. To all intents and purposes Jack disappeared many years ago. The last time I heard of him was in 1909 when his picture and a short biographical sketch was published in the *International Molder's Journal* in an article marking the golden jubilee of the organization. His picture was shown among about 20 others of men who had been in continuous membership for 50 years or more. The list included John G. Weaver, Jos. A. Barford, William McLaughlin, Henry Cribben, Jos. F. Dugdale, William Graham, Peter Carrol, W. J. Clark, James McArdle, John V. Barry, Peter Bovee, John Many, Thomas Fairly, Sylvester Harvey, Thos. Notley, Adam Stephans, A. Shilling, James Crowley, John Manwiler, John Dailey and Patrick Grimes.

"At least two of these men, Henry Cribben, Chicago, and William Graham, Pittsburgh, were prominent stove foundry proprietors for many years, but so far as I know not one of the list is alive today. I never have seen any of their obituary notices, but at the same time it is unreasonable to expect that they still are in the land of the living. Does not that prove the truth of the old tradition that they simply disappear?"

"Your argument," I said, "is ingenious, but like many other arguments it will not bear close scrutiny. Thousands of men die every year and you never see any notice. At various times during the past 20 years I have seen reference to the death of several of the men you listed. I have not actually attended the obsequies of any of the grand old veterans, but I am willing to believe that they passed through the valley of the shadow with the same steadfast courage that carried them so far on the highway of life. In fact I should not be surprised to learn that they gladly and wearily laid down the tools when the wind went on for the last time and let some other men pour off the heat and attend to other details."

"Yes," said Bill. "I guess they laid down the tools willingly enough. Any man who has worked in a foundry for 50 years is entitled to a rest. A molder's idea of heaven is a place where he will have absolutely nothing to do. Where he will not even have to think. If castings are made on the other shore, then most assuredly, every one will be perfect and as slick as an onion. The unfortunate molder has had a taste of the other place in this life every time he has put his best thought and endeavor into a mold and then dug the casting out of the sand on the following morning and found that it was nothing but a hunk of scrap. When the experience is repeated several times in succession he willingly could trade places with Job and consider himself the gainer.

JOHNNY WALKER'S FIRST COUSIN

"The other day I had an inquiry from a man who enclosed a sketch of a superheater casting that had him up in the air. It was quite a sizable casting made up of two 10-inch pipes about 15 feet in length joined together in the shape of an X and with the ends turned at an angle of 90 degrees. It was estimated to weigh about 3700 pounds and was poured with two ladles filled from one cupola. The iron in the first ladle was covered with charcoal and allowed to stand for about 10 minutes until a sufficient amount was collected in the second ladle. The cupola charges were made up of 1000 pounds pig iron with a silicon content of 2.75 per cent and the remainder of the charge machinery scrap. The casting presented a uniform thickness of 1 inch and had to resist a water pressure of 70 pounds per square inch.

"He said he had made a few molds neck down in a dry sand mold and had placed stud chaplets on the core. Examination later showed that the chaplets had flattened out and allowed the core to rise, thus reducing the thickness of metal on the top side. He now proposed to mold the casting in the opposite position, that is with the necks pointing up and in addition he was going to elevate one end of the flask about 24 inches above the floor level before pouring the metal.

"In this manner he expected to get a clean casting, or in the event that a little dirt appeared it probably would float to the top of one of the necks where it would not constitute a cause for rejecting the casting. Also he intended to employ ⅜-inch stem chaplets, tinned to insure a tight fit. He wanted to know what I thought of the proposition in general and if I favored his proposed method.

"Even with the best intentions in the world, long distance advice cannot take the place of that delivered on the spot where all the evidence is in full view. The proceeding is analogous to a coroner attempting to hold an inquest without what the lawyers call the corpus delicti and the man in the street refers to indifferently as the stiff. Any one or even a combination of several causes might have been responsible for the loss of the casting. Instead of claiming, arbitrarily, that this or that factor was responsible I forwarded a brief description of how the job should be handled.

"With proper supervision, I claimed, and in the hands of a competent molder, no trouble should be experienced in making this casting either in a green sand or a dry sand mold, or with the necks pointing up or down. The cheapest method of making the casting, where a considerable number are ordered is to bed it in the floor, necks down in a green sand mold. A short piece of rail at each end will serve as a permanent core support and two other short pieces will serve as permanent straightedges on which to form a level bed to support the main part of the pattern. A flat cope with a few gaggers or soldiers to support the sand at the end pockets may be rammed quickly and if done properly the cope may be lifted and finished without rolling it over. Putting down a coke bed and arranging the rails will occupy a few hours the first day, but after that two men should make a casting every day.

"However, since he already had a flask prepared to mold the casting necks up in dry sand, I assumed he had a good reason for preferring that method either on account of the insurance which that method offers or because his men were not accustomed to molding heavy castings in green sand.

"The mold is rammed in the usual manner with two, small, flat, draw gates near the bottom at each end. After the cope is lifted and rolled on its back, the sides of the neck core prints are shaved and the top of the core prints is cut through the cope. The mold is blacked and placed in the oven. On the following day it is removed and set up level on the floor. It is not necessary to elevate one end. In fact a certain amount of danger attaches to attempting anything of the kind. Usually if the men are not familiar with the practice, they neglect to block up the bottom plate properly in the center, with the result that the casting will strain at the bottom and come out thick and overweight.

"If the core is sufficiently stiff, no chaplets will be required on the bottom side. The core undoubtedly may sag a little, but the pressure of the molten iron will raise it to where it belongs. In the event that the core sags unduly, it may be advisable to place two 1-inch stud chaplets, one under each part of the core near the center.

"Instead of supporting the core on chaplets in the drag, it is advisable to suspend it from the cope by hooks in the end prints. To locate the core properly in place, it is lowered into the drag and allowed to rest on pieces of 1-inch board. The cope then is lowered into place on the drag and a few iron wedges are placed between the tops of the core and the underside of the cope bars that span these prints. Hooks are attached to the loops in the core and drawn up firmly. Gate pins or pieces of pipe are placed in the vent holes and then the open spaces on top of the core prints are rammed full of green sand.

"The cope with the core attached is lifted off and either is set up on horses or left suspended from the crane while the clearance around the core prints at each end is packed full of sand, blacked and dried with a torch. This latter precaution is optional. Usually the green sand is safe enough. The object of course in packing around the core is to prevent an unsightly fin around the core and to save chipping labor later. The boards are removed from the drag, any dust or dirt is blown or brushed out and the cope and core lowered into place on the drag. The two parts of the flask then are clamped together and after the chaplets have been secured the mold is poured.

"Six chaplets will be required in the cope, three on each side. It is optional whether these chaplets are driven before or after the cope is dried. Also it is optional whether the chaplets are held down by rails clamped across the cope, by lugs on the bars or by weights. Chaplets driven while the cope is green may be slicked into place. This will hold them in place when the cope is rolled over and also will eliminate the necessity of chipping away the usual lump of iron that surrounds any chaplet driven through a dried cope. They are driven into the cope until the head projects 1 inch and therefore when they are wedged at the other end it is not necessary to push them down any farther and encounter the usual dust which accompanies such an action.

"Dirt in a dry sand mold is caused either by a damp mold, a damp core or a core from which the vent does not escape readily. The interior of the core should be filled with coke or cinders and generous passages should be provided for the escape of gas generated when the core is surrounded entirely with iron.

THE RATTLER ABOUT TO STRIKE

"This casting will contract approximately 2 inches and the rods, pipes or arbors employed for reinforcing the core will have to be placed in the core with this contingency in view. For the same reason it will be necessary to remove the cope immediately after the casting has set. Otherwise the bars may prevent the casting from contracting normally. This is one of the reasons why I favor molding the casting in the opposite position. There is no danger of cracking the necks. However, with the necks up, the face of the casting may be covered with loose sand after the cope is removed. If the bare face is left exposed the casting certainly will warp out of shape.

"Handing out advice," said Bill, "without a sight either of the man or the job reminds me of the story of the office boy employed by a theatrical manager who nearly caused the death of the famous Sarah Bernhardt, who as all the world knows was equipped with an artificial limb. After being cruelly hoaxed on the telephone several times April 1 this office boy was all set for the next call. Unfortunately this time the call was genuiue. 'This is Bernhardt speaking,' said the voice. 'Is zat so?' says our hero. 'Gee, kid, I'm glad to hear from you. How's the old peg leg today?' "

Castings Freight Rates Are Attacked

Starting purely as a Michigan matter, the controversy on freight rates on gray iron, malleable and steel castings, manufactured in that state, has entered the general rate investigation which recently was begun in Pittsburgh, continued in Columbus, O., Detroit, in Chicago. The Detroit hearing was held on April 27 and 28 before J. B. Campbell, commissioner, interstate commerce commission. A. W. Dahlstrom, Muskegon, Mich., testified that intra-state and interstate freight rates on castings in Michigan, Ohio, Indiana and Illinois should be the same, especially within a radius of 200 miles. H. E. McGivern, traffic manager, Motor Wheel Corp., Lansing, Mich., presented a strong case against the Michigan zone system. Gordon Riley, representing the Benton Harbor Malleable Foundry Co., and others testified that because of Michigan rates they are shut out of shipments to Chicago and cannot get their share of business in Indiana and Illinois.

Book Review

Danish Foundrymen's Handbook. Entitled *Lommebog for Jern-og metalstoebere,* edited by Frederik A. Krog, consulting foundry expert, and published by the Danish Foundrymen's association. The publishing house is Teknologisk Instituts Forlag; Copenhagen, Denmark, and the book is in the Danish language.

A comprehensive little book of 347 pages, prepared as a foundryman's handbook. First is given enough mathematics to enable the calculation of weights of castings, then the physics and chemistry of cast iron, foundry materials, molding and melting practice, nonferrous practice, testing materials and the foundry product, first

aid and tables of weights and measures.

These foundrymen's handbooks in the different languages of the foundry world, and written by a foundryman in each case who is familiar with the peculiarities of the practice in his own country, are a welcome addition to the literature of the industry, and serve to spread information for the betterment of practice where most needed.

Need Low Carbon Pig for Malleable

By Enrique Touceda

THE question of the proper amount of total carbon that the malleable founder would prefer in pig iron for the production of air furnace white iron castings must be considered from different angles. That is, is it desirable or advantageous from an economic standpoint to use some character of low carbon scrap on his mixture, or to make use of pig and sprue only? While silicon is the acknowledged scrap carrier in the case of cupola gray iron castings, carbon performs this role for the most part in malleable iron practice, irrespective of the character of furnace used for the production of the white iron castings. In this particular the advantage lies with the maker of gray iron castings in that the silicon content in pig iron through a regulation of furnace temperature is under control by the blast furnace manager, while he has little or no control over the resultant percentage of carbon. This is dependent on the quantity of coke in the hearth, and hearth temperature, coupled with the amount of hearth slag and its particular composition. Inasmuch as perhaps more than 95 per cent of white iron castings are made in air furnaces the following statements are intended to cover that situation.

Composition Is Limited

In the malleable process the composition of the hard iron castings that is determined upon as best suited for the work in hand, is the one factor that must control the composition of the mixture to be used; because if the elements are not each between certain definite limits individually and collectively the annealed or finished product will not be suitable. This may be due to lack of sufficient strength or because it may be too hard to machine easily. The annealed product can be divided into two principal classes. By far the largest tonnage goes into parts for machines where high strength and ductility are essential requisites, while a less amount, light in weight and thin in section, goes into other manufactured products in which castings of any reasonable degree of strength and ductility have proved satisfactory.

When comparatively high strength and ductility are essential characteristics as usually is the case, the white iron castings should not contain a carbon content in excess of 2.50 per cent, so that the carbon in the annealed casting will be sufficiently low. For higher strengths a total carbon content considerably lower than 2.50 per cent is more desirable. Under the assumptions that the ratio of pig to remelt (sprue) in the regular mixture is 60:40; that the pig iron will average 3.75 per cent in total carbon; that the average loss in carbon in air furnace practice will average 0.55 per cent actual, and that the percentage of carbon desired in the white iron castings is 2.50 per cent, it is manifest that if the conditions cited are fulfilled a white iron will be obtained that will be considerably higher in carbon than the desired amount.

Gives Views

ALTHOUGH low carbon pig irons, made in the blast furnace or synthetically, are being produced for a variety of purposes in Europe, as yet little recognition has been given to this subject in this country. Enrique Touceda, Albany, N. Y., an internationally known authority on the malleable industry, presents an argument for the use of low carbon pig iron in this field and the advantages to be derived from its use. This article is abstracted from a paper presented at the New York meeting of the American Institute of Mining and Metallurgical Engineers held recently.

Briefly it may be said if pig iron is to be used, and a strong casting is desired, less than 60 per cent of pig must be incorporated in the mixture and a certain percentage of steel or annealed malleable iron, or both substituted in its place so that the carbon content of the white iron castings will not exceed 2.50 per cent. It might be possible through the use of iron ore, mill scale, etc., to lower the carbon to the desired limit instead of using steel scrap, or again a combination of the two methods can be employed. However, the main objection to the use of steel scrap in the mixture is that it is likely to carry an objectionable amount of chromium or other undesirable impurities. To a less extent this obtains also in the case of miscellaneous malleable iron scrap.

Advantages of Low Carbon Pig

If the foregoing is true, it is at once apparent that even if carbon in pig iron is considered in the light of a scrap carrier, no possible advantage arises from the use of high carbon pig iron. First, because the use of the mixture of steel or malleable scrap introduces a serious uncertainty regarding what objectionable impurities these products may carry, and second, because at times there is little, if any, difference in cost between scrap and pig iron. Consequently, the only logical conclusion is, that it would be greatly to the advantage of the manufacturer of air furnace malleable castings, if he could purchase the bulk of his pig having a carbon content not in excess of 3.00 per cent.

If it was lower no damage would result as there would be no difficulty in raising the carbon through the use of higher carbon iron. Stated in another way, if a 3 per cent carbon pig could be purchased to form the base, mixture control as far as carbon is concerned would be facilitated to a large extent. Use of such iron would serve to eliminate many of the difficulties that exist today, making possible final adjustment through the use of a minimum amount of additions whether the latter are for the purpose of raising or lowering the carbon. It might be pointed out that air furnace temperatures cannot be manipulated so that the carbon can be oxidized preferentially to the silicon as is possible in some other processes.

The writer recognizes the fact that the making of a pig iron running 3 per cent or lower in carbon regularly cannot be effected in the blast furnace proper, but he does believe it would be possible and practical to do this through an auxiliary installation in the cast house.

Above — Sections of the statue in Position Ready for Welding. Right— Welding the First Joint. View of the Statue from the Front

Above — The Last Section Being Moved into Place. Below— Chipping Off the Rough Spots. Later the Joints Were Colored by Heating

Above and Lower Right— Welding Operations Necessitated the Maintenance of Precarious Positions at Times

Left Above—Finishing the Seam. To Make the Joint Less Noticeable, the Metal Was Worked from Center to Edge

Memorial Statue Is Welded Into One Piece

ONE of the many memorial statues, erected in various parts of the country and dedicated to these who participated in the nation's conflicts, is located in Newark. N. J. This memorial group called, "The Wars of America," is placed in Military park. It is 40 feet long, 15 feet wide and about 17 feet high, and is composed of 42 heroic figures including women, men and horses. The group which symbolizes the participation of the people in the conflict; the eager and determined soldiers being heartened and supported by those they protect, was designed by Gutzun Borglum, the famous sculptor and was cast in Italy.

After their arrival at Newark the sections were assembled and later were welded together to form one piece under the direction of Mr. Borglum. Considerable experimental work was necessary to perfect an adequate welding technique and to match the bronze of the statue with the welding rods.

In addition to welding the sections together, considerable other welding was performed to correct defects, attach parts broken off in transit, and to add metal to bring out points in the contour of the group. Variation in thickness of the metal made welding difficult as in some places the section was 2 or 3 inches thick and in others ⅛-inch. Welding on the light metal was carried on carefully to prevent cracks and checks.

WHAT OTHERS ARE THINKING

Abstracts Selected from the World's Foundry Literature

Observes Diffusion

Diffusion in the Metallic State, Especially that of Sulphur and Phosphorus in Cast Iron, by Franz Roll, *Die Giesserei*, Jan. 1, 1927.

Numerous observations of diffusion in the gaseous and fluid state have given rise to the laws of Fick and Stephan. However, in the metallic state diffusion velocity is not bound to molecular magnitude. The classic example of diffusion in solid bodies is that observed in platinum-gold by Roberts-Austein, that these two elements could penetrate into another. In the solid state diffusion exceeds the solubility of both elements in each other if a chemical reaction can take place between the penetrating element and the ground mass. G. Meyer who studied the velocity of diffusion noted a dependence between the internal friction and the velocity of diffusion and stated that diffusion is first of all a function of the time and temperature. At ordinary temperature the speed of diffusion for the most part is infinitely small or so great that it is observed only after days. The author investigated the effect of solid and liquid sulphur, hydrogen sulphide and sulphur dioxide on specimens of cast iron. He found by metallographic and chemical analyses that these materials have considerable effect on the structure. Although abnormal relations seldom happen in practice the structure alteration possibilities of sulphur must be kept in mind. Speed of diffusion was decreased exceptionally by oxidizing influences. In a bomb-tube filled with nonoxidizable gas and heated to 270 to 300 degrees Centigrade for two hours, a greater diffusion of the phosphorus eutectic was observed. In summarizing the author states that the diffusion of sulphur and phosphorus in cast iron plays an important part and is dependent on the temperature during the changes going on in the ground mass. In spite of the outer rigidity of the material diffusion can extend to considerable proportions.

Use of Fluorspar

The Rational Use of Fluorspar in Foundry Cupolas, name of author not given. *La Fonderie Moderne*, Jan. 1927. Apart from its use in the process developed by Rollet, fluorspar is not used systematically in current foundry practice. In a brief summary of the working of the cupola the drawbacks of the use of lime as a flux are pointed out, particularly its viscosity and the fact that the resulting slag cannot be used for any practical purpose. Fluorspar has a lower melting point, a greater fluidity, and it gives a slag that can be used in construction. Its greater fluidity enables the molten iron to pass more rapidly before the tuyeres, consequently there is less oxidation. Fluorspar being more fluid than lime, less metal is retained in it and the loss from this cause is reduced from 6 to 7 per cent to 2 or 3 per cent. Fluorspar also acts as a desulphurizing agent and decreases the absorption of phosphorus by the metal. Its lower melting point causes more heat to be available for the metal, resulting in an economy of fuel. Fluorspar should not be used alone, but as a partial substitute for lime in the average proportions of 1.5 per cent fluorspar and 2 per cent lime for 100 of coke containing 13 per cent ashes.

Determine Calcium Content

Estimation of Calcium in Aluminum Alloys, by P. G. Ward, *Metal Industry* (London), April 15, 1927:

Two grams of the alloy are treated with 15 cubic centimeter of caustic soda solution (1 in 2). When all action has ceased the liquid is diluted to 300 cubic centimeter with hot water, and allowed to stand on the steam bath until the precipitate has settled. The latter is filtered off and washed once with hot water. The iron and aluminum are separated from the calcium by dissolving the precipitate in hydrochloric acid, making the solution practically neutral with ammonium hydroxide and precipitating with an excess of 10 per cent ammonium benzoate solution. The calcium in the filtrate is precipitated as oxalate and weighed as oxide in the usual manner. The accuracy of this method has been checked by the three following methods: Removal of the aluminum by volatization in a current of chlorine and estimation of the residual calcium; removal of the aluminum by precipitation as hydrated chloride (Havens) and estimation of calcium in the filtrate; precipitation of the calcium as oxalate in presence of the aluminum, the latter being kept in solution by ammonium citrate.

Describes Loam Molding

Loam Molding and Some of Its Applications. A paper read by Henri Capé of the Societe Anonyme des Fonderies de Saint-Ouen (Seine) before the Association Technique de Fonderie. *La Fonderie Moderne*, Paris, February, 1927.

The author estimates that loam molding deserves more attention than it usually attracts owing to the value of this process when making heavy castings. It is difficult nowadays to find molders with a good experience along these lines. Details are given as to the general way in which the strike should be prepared, and the method of fixing it on the vertical shaft, the reason being given why the bevelled edge of the strike should rotate sunwise. The author then describes the process as used in a number of selected cases, as truck wheel, pulleys with elliptic arms and various shapes of pipe fittings.

Making Synthetic Iron

Concerning the Melting of Steel Scrap in the Cupola, by Marcel Guedras. *La Fonderie Moderne*, Paris, February, 1927.

Referring to the Remarks by an Old Chemist published in a previous issue of *La Fonderie Moderne*, abstracted in THE FOUNDRY of Jan. 15, M. Guedras states that steel scrap melted with coke in the electric furnace or in the cupola gives exclusively pig iron; it is a method of producing synthetic pig iron. The operation of the cupola now may be conducted in such a way as to obtain a determined analysis of cast iron. The use of ferrosilicon briquettes containing a determined percentage of silicon enables definite results to be obtained as referred to the silicon content in the final cast iron.

Cast Iron Growth Determined

The Heat Treatment and Growth of Cast Iron, by J. W. Donaldson, *Foundry Trade Journal*, Feb. 17, and Feb. 24, 1927.

Experiments were performed on test bars of ordinary cast iron and on test bars with pearlitic structure made under a patented process. The tests were divided into two groups, one dealing with carbide decomposition, strength and hardness, and the other with carbide, decomposition was found to take place in all bars, but varies considerably, depending on the temperature of treatment and the iron tested. At 200 degrees Cent. the amount of decomposition after 200 hours' treatment is almost negligible. In summarizing the author draws the following conclusions: Carbide decomposition, accompanied by graphite decomposition, takes place in gray cast iron when subjected to low temperature heat treatment; Stability of the carbide is influenced by the silicon content of 0.9 per cent with a pearlitic structure and 1.0 per cent or less of silicon gives the greatest stability; Stability also is influenced by the temperature and the duration of heat treatment. At 200 degrees Cent. the change is not noticeable except over a long period of time. Over 200 degrees the rate of change varies with the temperature and nature of the iron; Carbide decomposition also affects the mechanical properties of gray cast iron according to the condition and duration of heat treatment; Growth and volume changes are in some ways related to carbide decomposition, but not wholly explained by it.

The Shakeout

DAN M. AVEY, Editor

PAT DWYER, Engineering Editor
FRANK G. STEINEBACH, Associate Editor

CHARLES VICKERS, Nonferrous Editor
EDWIN BREMER, Associate Editor

¶ It Still Pays

THROUGH one cause and another the subject of apprenticeship training has been kept fairly well in the limelight during the past few years. Many men have devoted considerable time and earnest consideration to an attempted solution of the problem. Various forms of apprenticeship have been tried, ranging from a regular shop course of three or four years, down or up, depending on the reader's point of view, to a modified form that may include anything between a special intensive course of one or two years, and the 40 or 50 hours' instruction in foundry practice which the students in our engineering schools receive.

AT ONE time every foundry had a waiting list of boys who were anxious to learn the trade. A certain prestige attached to the skilled mechanic as compared to the man who had no regular form of employment. Also, and that was an argument as potent then as now, he earned more money. Gradually the waiting list of boys has disappeared and while many theories have been advanced to account for this phenomenon, only a comparatively few people seem to realize it has been due to two main causes. One is that with a long list of boys available, the foundryman only picked out the most highly endowed. Consciously or unconsciously the standards for admittance were raised higher every year and as a result the ordinary run of mine boy became discouraged and sought employment elsewhere. The second reason is that the parents of the more desirable class of boys have been in a position in recent years to send them through the higher schools. Without attempting to analyze the reason it is a matter of common knowledge that it is as easy under modern conditions to shove a camel through the eye of a needle as it is to persuade a high school graduate to enter a foundry as an apprentice.

AS ONE contribution to the general discussion it might be suggested that interested employers in any community take a generous slice of advertising space in their local papers to sell the idea of apprenticeship to the boys. Accept the candidates when they appear without subjecting them to a civil service examination, pay the boys a fair wage based on local conditions and—let nature take its course.

¶ Can Weak Knees Be Cured?

GENIAL IRVIN COBB, in one of his favorite stories tells of the inebriate who put the world traveler is his place by asking him if *he* ever had experienced the delirium tremens. The crushing following remark of the gentleman overcome with liquor was, "and ef you aint, you aint been no place and you aint seen nothin' yet."

SOMETHING of the same nature, more politely expressed would be the words of the foundryman today engaged in making automotive castings to a jobbing shop proprietor who never has essayed to make cylinders, cylinder heads, gear cases or any of the variety of castings now used in such huge quantities in automobile manufacture. Some of the grief of this line of work comes from within. A case is cited of a head made in a Michigan shop of some forty years' experience and sold to an automobile manufacturer at 60 cents, and as the teller of this story remarked, "it was a crooked one too." This job was bid in by an Ohio foundry when the old established Michigan shop failed, for 30 cents. However, the Ohio adventurer lost in turn to an Indiana foundry that is said to be making the casting at 21 cents.

ANOTHER cause for sorrow in this line of work is the insistence of automobile manufacturers upon analysis or certain metal additions as well as physical requirements. The foundryman practically is forced in this day and age to use alloys which while undoubtedly beneficial to the castings cost more money. When the foundryman buys and uses these alloys and the customer analyzes his cylinders and finds the metalloids upon which he has insisted, does the purchaser say, "Jim, old man, your metal costs you more if you use this alloy, and we'll jack up the price on that cylinder a quarter?"

Don't Ask Me Another!

Trade Trends in Tabloid

FOUNDRY activity is varied and cross hatched with irregularities. These contrasts in the state of business do not follow the fortunes of any geographical division, nor any class of manufacture. Some automotive shops are working to capacity, while within a few miles others may be found that barely are producing enough to keep in motion. General jobbing gray iron shops are fairly busy in most sections, but competition has forced prices to ruinous low levels. While freight movement continues at a peak, railway purchases still are light. April pig iron production showed a gain over March, according to *Iron Trade Review*. The daily average output for April was 1500 tons ahead of the preceding month. However, the production of merchant iron declined from 762,354 tons in March to 739,927 tons in April. Average daily prices for nonferrous metals during April, according to New York reports in the *Daily Metal Trade*, follow: Casting copper, 12.998c; electrolytic copper, 13.053c; Straits tin, 68.152c; lead, 7.126c; antimony, 14.266c; aluminum, 98 to 99 per cent, 25.625c. Zinc was 6.354c, E. St. Louis, Ill. Brass foundry operations continue to improve in the midwestern cities. Demand for plumbing goods is reported fair, supported by sustained building operations that approach last year's totals. Aluminum casting demand remains low.

RAW MATERIAL PRICES
May 6, 1927

Iron

No. 2 foundry, Valley	$18.50 to 19.00
No. 2 southern, Birmingham	18.00
No. 2 foundry, Chicago	20.00
No. 2 foundry, Philadelphia	21.76 to 22.13
No. 2 foundry, Buffalo	17.75 to 18.00
Basic, Valley	18.50 to 19.00
Basic, Buffalo	17.25 to 17.75
Malleable, Chicago	20.00
Malleable, Buffalo	17.75 to 18.00

Coke

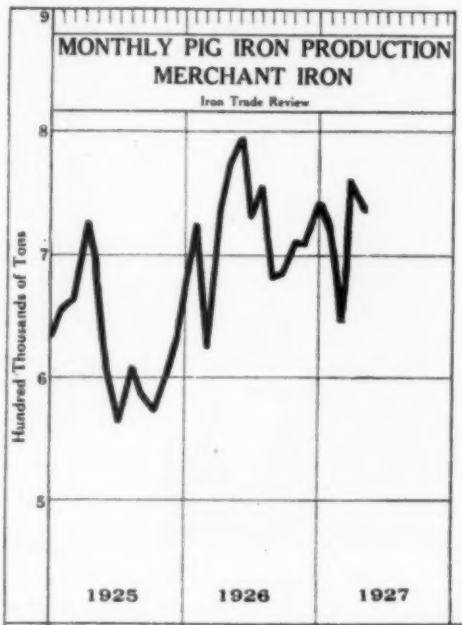
Connellsville foundry coke	$4.00 to 4.75
Wise county foundry coke	6.00

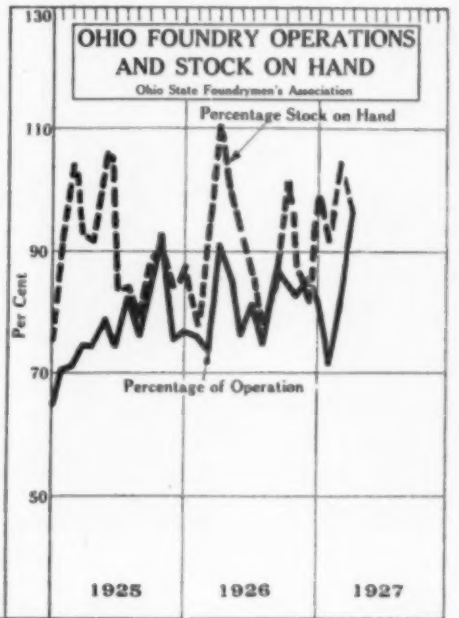
Scrap

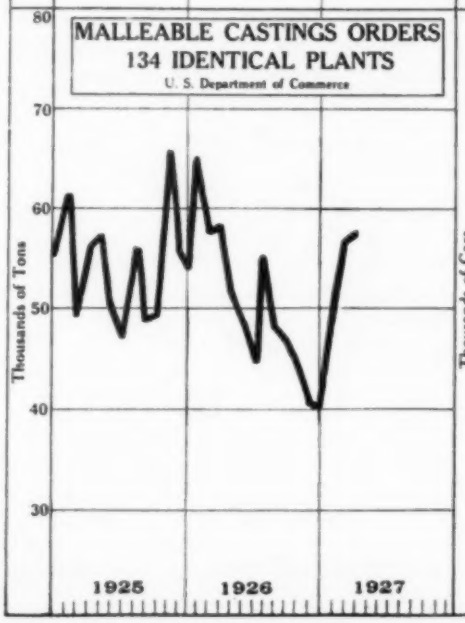
Heavy melting steel, Valley	$15.50
Heavy melting steel, Pitts.	15.50 to 16.
Heavy melting steel, Chicago	12.75 to 13.25
Stove plate, Chicago	13.25 to 13.75
No. 1 cast, New York	14.00 to 14.50
No. 1 cast, Chicago	15.50 to 16.00
No. 1 cast, Philadelphia	17.00 to 17.50
No. 1 cast, Pittsburgh	16.00 to 16.50
No. 1 cast, Birmingham	15.00 to 16.00
No. 1 cast, Buffalo	16.00 to 16.50
Car wheels, iron, Pittsburgh	16.00 to 16.50
Car wheels, iron, Chicago	14.50 to 15.00
Railroad malleable, Chicago	15.50 to 16.00
Agricultural, Mal., Chicago	14.25 to 14.75
Malleable, Buffalo	17.00 to 17.50
Railroad malleable, Pitts.	16.00 to 16.50

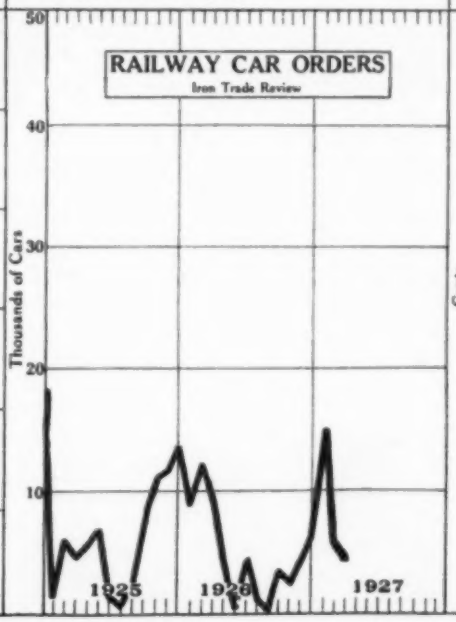
Nonferrous Metals

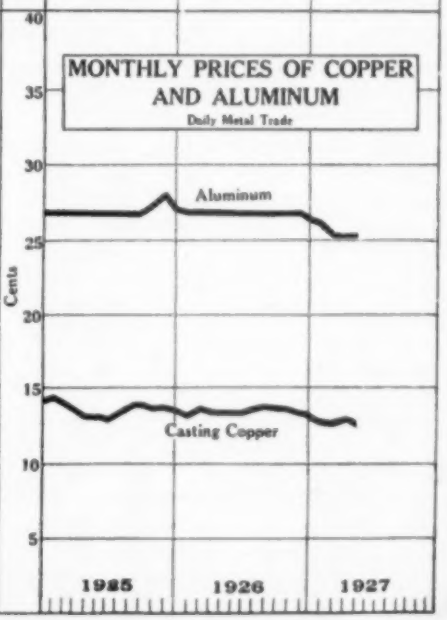
	Cents per pound
Casting copper, refinery	12.75
Electro copper, producers	13.00
Straits tin	68.25 to 68.50
Lead, New York	6.70
Antimony, New York	12.75
Nickel, electro	39.00
Aluminum, No. 12, prod'rs	24.50
Aluminum, No. 12 remelt	20.50
Zinc, E. St. Louis, Ill.	6.15











Comings and Goings of Foundrymen

ROBERT ALEXANDER BULL, Electric Founders' Research group, Chicago, has been awarded the Joseph S. Seaman gold medal by the American Foundrymen's association in recognition for his services to the association and to the foundry industry at large. He was born in New Albany, Ind., on June 28, 1874. He was educated at De Pauw university and later at Butler university from which he was graduated with a bachelor of arts degree. Later, he received the master of arts degree from St. Louis university. Mr. Bull's

MAJOR R. A. BULL

early industrial experience was in the employ of Robert W. Hunt & Co., the American Pipe & Foundry Co., Bessemer, Ala., the water department of Louisville, Ky., and the Shickle, Harrison & Howard Iron Co., East St. Louis, Ill. Later Mr. Bull held positions of importance with the Leighton & Howard Steel Co., East St. Louis, the American Steel Foundries, Commonwealth Steel Co., Chicago Steel Foundry Co., and the Dusquesne Steel Foundry Co., being vice president and general manager for the last two firms. He was commissioned a major in the ordnance department, United States army, and served in the division of construction and maintenance of the American Expeditionary forces. Major Bull has been research director of the Electric Steel Founder's Research group since its formation in 1920. He was a district vice president of the American Foundrymen's association in 1911, first vice president in 1914, president in 1915 and re-elected in 1916. From 1917 to 1925 he served as a director of the association. Major Bull has been a prolific contributor to the technical press and has served as a member and chairman of many important committees. He is a member of numerous technical societies including the American Institute of Mining and Metallurgical Engineers, American Society for Testing Materials, American Foundrymen's association and the Institute of British Foundrymen.

Henry Fagan, superintendent of the service department, Landers, Frary & Clark, New Britain, Conn., manufacturer of hardware and cutlery, has completed 60 years of continuous service with that firm. Mr. Fagan started with the company at 17 years of age and never has had any other employment.

Robert Buchanan has resigned his position as foundry foreman for the Los Angeles Valve & Fitting Co., Los Angeles.

William C. Riley, president of the Valley Iron Works, Williamsport, Pa., will retire from active business after 50 years', service. Mr. Riley succeeded his father who also was an executive in the firm before him.

J. L. Christie, metallurgist, Bridgeport Brass Co., Bridgeport, Conn., has been appointed representative by the American Society for Testing Materials to the soil corrosion conference held under the auspices of the United States bureau of standards.

Henry Tscherning, molding machine designer for the Arcade Mfg. Co., Freeport, Ill., will sail on May 28 for Sweden and Denmark.

D. M. MacDowell has been appointed in charge of the Chicago office of the Chambersburg Engineering Co., Chambersburg, Pa.

Robert P. Lamont, president, American Steel Foundries, Chicago, has been elected a member of the board of directors, United States chamber of commerce, from the sixth district.

A. H. Elliot, recently elected a vice president of the Southern Wheel Co., with headquarters in New York, formerly was with the American Brake Shoe & Foundry Co. that city. The Southern Wheel is a subsidiary of the American Brake organization.

Makes World Trip

Atherton Clark, export department of the Black & Decker Mfg. Co., Towson, Md., manufacturers of portable electric tools, now is making a year's trip through Hawaiian Islands, Australia, New Zealand, Ceylon, India, Siam, China, Japan and Korea, visiting distributors of the firm's

ATHERTON CLARK

products. Mr. Clark has been associated with the export department of Black & Decker for several years.

Receives Silver Service

J. E. O'Brien, Fanner Mfg. Co., Cleveland, retiring president of the Purchasing Agents' Association of Cleveland, was presented with a silver coffee service in appreciation of his work at the recent meeting of the association held on April 25. C. W. Head, Aluminum Co. of America, was elected to succeed Mr. O'Brien. Other officers elected are D. N. Snetzinger, Broadway, New York.

The North American Engineering Corp. has removed its office to 50 Broadway, New York.

Obituary

William Goodman, vice president, Worthington Pump & Machinery Corp., New York, who died April 21, achieved prominence in the engineering field by his direction of work in connection with the development of the double-action diesel engine. He was born 52 years ago in Cincinnati and entered the engineering department of the Laidlaw, Dunn Gordon Co. of that city following his graduation from Harvard university in 1896. When that firm was absorbed by the Worthington corporation, Mr. Goodman became general manager of the Cincinnati branch. He was transferred to New York in 1918 as assistant to the vice president. Four years later he was made vice president in charge of manufacturing.

Edgar Raysor, for the past 15 years fitting sales manager for Stanley G. Flagg & Co., Philadelphia, died at his home in that city, April 22, aged 60 years. He had been associated with the company for 30 years.

John R. Hilton, treasurer, Mechanics Foundry & Machine Co., Fall River, Mass., died at his home in that city recently after a brief illness. Prior to his association with the Mechanics company, he was master mechanic for the American Print Co. for 25 years.

Moses J. Perault, owner of the Fitchburgh Foundry, Fitchburgh, Mass., died at his home in that city on April 23 after a long illness. Mr. Perault purchased the plant of Marshall & Farnsworth in 1884 and conducted the business as the Fitchburgh Foundry for many years. He also was active in other lines of manufacture and was connected with the Brown Engine Co., and several other metalworking plants at Fitchburg.

Faked Foundry Facts

A Tight Band

Will Hold Conference on Steel Treating

Purdue university, Layfayette, Ind., will hold a conference on steel treating at the university under the direction of the engineering extension department and the department of practical mechanics on May 26 and 27. Thursday, May 26, will be devoted to registration; heat treating demonstrations; inspection trips; manufacture of iron and steel; spark test demonstration; and annealing and its importance in steel treating. At 6:30 p. m. a dinner will be held. Friday, May 27, will be given to heat treating demonstrations; critical temperatures of steel; methods of heat treating; carbonizing; tools and their heat treatment; heat treating of machine parts; and quenching.

Egan, Webster & Co. Inc., fire clay, firebrick, loam and sand producer, has removed its office from 1 Broadway to 50 Broadway, New York.

Foundry Association Directory

American Foundrymen's Association

President, S. W. UTLEY, Detroit Steel Casting Co., Detroit; secretary-treasurer, C. E. HOYT, 140 South Dearborn street, Chicago; technical secretary, R. E. KENNEDY, 909 W. California street, Urbana, Ill.

The Buffalo Foundrymen
Buffalo

President, J. MCARTHUR, Washington Iron Works; secretary, W. J. WARK, E. J. Woodison Co., 146 Chandler street. Meetings the third Wednesday of the month at 146 Chandler street.

Chicago Foundrymen's Club
Chicago

President, G. H. ROLINSON, American Brake Shoe & Foundry Co.; secretary, ALBERT N. WALLIN, S. Obermayer Co., 2563 W. Eighteenth street. Meetings second Saturday in each month at the City club, 315 Plymouth court.

Connecticut Foundrymen's Association

President, FRED W. STICKLE, Capitol Foundry Co., Hartford, Conn.; secretary, C. S. NEUMANN, Union Mfg. Co., New Britain, Conn. Meetings are on second Friday of each month in various parts of the state.

Detroit Foundrymen's Association
Detroit

President, ROBERT G. CRAWFORD, Atlas Foundry Co., 131 Artillery street, Detroit; secretary, RUSSELL M. SCOTT, Packard Motor Co., 1580 East Grand boulevard, Detroit. Meetings third Thursday in each month at the Union League club, 35 Grand River avenue, Detroit.

Metropolitan Brass Founders' Association
New York

President, WILLIAM EMBER, Jefferson Brass Foundry, 62 Delevan street, Brooklyn, N. Y.; secretary WILLIAM E. PAULSON, Thomas Paulson & Son Inc., 97 Second avenue, Brooklyn, N. Y. Meeting second Wednesday in each month at the Building Trades club, 34 West Thirty-third street, New York.

Newark Foundrymen's Association
Newark, N. J.

President, J. L. CARTER, Barlow Foundry Inc., Newark; secretary, W. H. MANTZ, Atlas Foundry Co., Irvington, N. J. Meeting called by president.

New England Foundrymen's Association

President, HENRY S. CHAFEE, Builders Iron Foundry, Providence, R. I.; secretary, FRED F. STOCKWELL, 205 Broadway, Cambridgeport, Mass. Meetings second Wednesday of each month at the Exchange club, Boston. Outings usually are held in the summer months.

Ohio State Foundrymen's Association

President, WALTER L. SEELBACH, Walworth Run Foundry Co., 2488 West Twenty-seventh street, Cleveland; secretary-manager, ARTHUR J. TUSCANY, 5713 Euclid avenue, Cleveland.

Philadelphia's Foundrymen's Association
Philadelphia

President, WALTER WOOD, R. D. Wood & Co., Philadelphia; secretary HOWARD EVANS, Union League club, Philadelphia. Meetings the second Wednesday of each month at the Manufacturers' club.

Pittsburgh Foundrymen's Association
Pittsburgh

President, LAWRENCE V. STEVENS, Locomotive Stoker Co. N. E. Pittsburgh; secretary-treasurer, WILLIAM J. BRANT, Wm. J. Brant, Bessemer building, Pittsburgh. Meeting on the third Monday of the month, except in July and August, at Fort Pitt hotel.

Quad-City Foundrymen's Association
Davenport, Iowa

President, J. H. DIEDRICH, Blackhawk Foundry & Machine Co., Davenport, Iowa; secretary-treasurer, A. D. ZIEBARTH, Davenport Foundry & Machine Co., Davenport, Iowa. Meetings the third Monday evening of each month, the meeting place being rotated between Moline, Rock Island and Davenport.

Southern Metal Trades Association
Atlanta, Ga.

President, GEORGE B. COCKER, Gastonia, N. C.; secretary, W. E. DUNN JR., Healy building, Atlanta, Ga.

Tri-City Technical Council
Moline, Ill.

Chairman, H. BORNSTEIN, Deere & Co., Moline, Ill.; treasurer, MAX SKLOVSKY, Deere & Co., Moline, Ill. Combined meetings held only one or two times a year on call.

Tri-State Foundrymen's Association
Cincinnati

President, HAROLD P. RITTER, John A. Oberhelman Foundry Co., 3323 Colerain avenue; secretary, GEORGE W. PIEHL, Wessling Bros. Foundry Co., 1607 McLean avenue. Meetings the second Thursday of each month at the Cincinnati club, Eighth and Race streets.

Twin City Foundrymen's Association
Minneapolis-St. Paul

President, H. H. NOTT, Smith System Heating Co., Minneapolis; secretary-treasurer, C. E. LANGDON, 3849 Lyndale avenue, south, Minneapolis. Meetings monthly at the Athletic club.

What the Foundries Are Doing

Activities of the Gray Iron, Malleable, Steel and Brass Shops

Elkhart Brass Co., Elkhart, Ind., has been incorporated with $250,000 capital.

Detroit Stove Works, Detroit, will build an addition to its enameling plant.

Berkley Machine Works & Foundry Co., Norfolk, Va., is planning to rebuild burned portion of its plant.

Wisconsin Iron & Metal Co., 164 Marion street, Oshkosh, Wis., will rebuild its burned foundry and refining plant.

General Foundry Co., Oshkosh, Wis., was damaged by fire that occurred in the adjoining Wisconsin Iron & Metal Co.

Mosher Steel & Machinery Co., South Lamar street, Dallas, Tex., has bought 30 acres and is considering erection of a new plant.

H. O. Lown, Texarkana, Tex., has bought plant and equipment of San Angelo Foundry & Machine Co., San Angelo, Tex., and will enlarge and add to equipment.

Wisconsin Iron & Wire Works, E. L. Richardson, secretary, 1660 Booth street, Milwaukee, has had plans drawn for a 2-story addition to its plant.

Star Foundry, Steel & Machine Co., San Angelo, Tex., recently organized, has bought a site and will build a foundry plant at Sweetwater, Tex.

Frederick Powell, Jersey City, N. J., has had plans prepared by Kelly & Cowan, architects, 921 Bergen avenue, for a 2-story foundry plant for making gray iron castings.

Jensen Foundry Co., Romeo, Mich., has been incorporated with $25,000 capital to operate a foundry by M. Jensen, Romeo, Mich., A. W. Lau and C. F. Anderson, Detroit.

Pullman Car & Mfg. Co., D. A. Crawford, president, Pullman building, Chicago, confirms project of building foundry at New Orleans, but plans are not sufficiently definite to indicate exact nature of product.

Best Die Casting & Metal Stamping Corp., New York, has been incorporated with $25,000 capital to make die castings and stampings, by Shorr, Brodsky & King, 41 Union square, attorneys.

The Alloy Cast Steel Co., Marion, O., has rebuilt the steel and iron foundries of the old Fairbanks Steam Shovel Co., into an electric steel foundry. The firm has a 3-ton electric furnace and manufactures steel castings up to 1000 pounds weight.

Capital Brass & Aluminum Foundry Co., 2454 Fullerton avenue, Chicago, has been incorporated to manufacture metal castings by Walter Hunter, Frank Kerbe, Fred Hoack Jr. and Ray Atley. John W. Follmer, 1907 North Kenneth avenue, is correspondent.

Harrison Radiator Corp., Frank M. Hardiman, manager, Washington street, Lockport, N. Y., has let contract to the Austin Co., Cleveland, for a 1-story foundry addition at 64 Lock street. The company also will build a further addition to its plant on Washburn street.

Union Metal Mfg. Co., 1432 Maple avenue, Canton, O., manufacturer of metal columns and lighting standards, will build a plant.

Blackhawk Foundry & Machine Co., A. Diedrich, manager, 323 Clark street, Davenport, Iowa, is considering building a 1-story brick foundry addition.

Charles A. Lind Pattern Works Inc., Harrison avenue and Ninth street, Rockford, Ill., has been incorporated with $25,000 capital to manufacture patterns and models, by Charles L. Lind, Roy W. Engberg and Herman E. Rupp. N. P. Nelson, 304 Reliance building, is correspondent.

Draper Corp., Hopedale, Mass., manufacturer of woodworking and textile machinery, has taken over the Hopedale Mfg. Co., Milford, Mass., manufacturer of looms and mill machinery. Clare H. Draper will become a member of the board of the latter company. (Noted March 15.)

Valley Iron Works, Inc., Williamsport, Pa., William C. Riley, president, has decided to go out of business. The plant will be offered for sale and operations will be terminated in about three months. The company was established in 1865 and specialized in heavy machinery.

Milford Column Co., Milford, Mass., has been incorporated with $50,000 capital by Grosvenor Calkins, Newton, Mass.; Gladys Mitchell, Somerville, Mass.; and Olive G. Curtice, Auburndale, Mass. It has bought the column manufacturing department of the Milford Iron Foundry Co. and will equip a plant for the manufacture of structural columns.

Central Pattern & Model Works, Chicago, has moved into its new plant at 3737 South Sacramento avenue. The plant is 40 x 100 feet. A brass and aluminum foundry department is being started. Frank P. Battle and Charles Zint Jr. are officers. The company will incorporate shortly under the name of the Central Pattern & Foundry Co., to cover enlarged operations.

Flood City Brass & Electric Co., Johnstown, Pa., which recently was organized, has bought the plant of the Flood City Mfg. Co., which was sold by the receiver. The company will manufacture bronze, brass and aluminum castings, hoists, electric welders, etc., for mines. C. N. Replogle is president and general manager; R. L. Swank, vice president, and S. A. Replogle, secretary and treasurer. It is not planned to build a new plant now. Some new equipment has been installed. (Noted May 4.)

New Trade Publications

FOUNDRY EQUIPMENT — The Badische Maschinenfabrik, Durlach, Germany, has published a 276-page catalog describing the various types of sand mixers, dryers, ball mills, screens, molding machines, annealing ovens, tumbling mills and numerous other pieces of foundry equipment. The catalog is illustrated well and is printed in German.

SPECTROMETERS — Adam Hilger Ltd., London, Eng., has published a bulletin containing references to spectrometers and kindred instruments.

FOUNDRY EQUIPMENT—The Brass Founders Supply Co., Newark, N. J., has issued a catalog describing its line of supplies for the brass foundry. Some handy data are included in the back section of the catalog.

RECUPERATOR—A bulletin has been issued by the Carborundum Co., Niagara Falls, N. Y., describing a new type of recuperator which is being manufactured by this firm. A longitudinal section of the recuperator is shown with text matter to explain the principles involved. The apparatus is designed for steel melting, reheating and normalizing furnaces; malleable furnaces and other furnaces using regenerators.

BLOW-OFF VALVE—Riley Power Equipment Co., Milwaukee, has issued a folder describing an automatic reseating blow-off valve that the firm handles. Sizes and types are given.

ELECTRIC TOOLS—Black & Decker Mfg. Co., Towson, Md., manufacturer of portable electric tools, has issued its 1927 catalog. It covers its tools, parts and attachments and points out new uses where results can be bettered by their application. It is profusely illustrated.

STEEL STAMPS—Pittsburgh Stamp Co., Pittsburgh, has issued two bulletins describing its letters and figures for marking steel, and its eye and fullered stamps for use on steel and other material. Information as to requirements of such stamps and their proper use is included.

MANOMETERS—Bacharach Industrial Instrument Co., Pittsburgh, has issued a bulletin covering its liquid manometers, characteristic of which is the use of a single tube. Various applications are illustrated and test outfits described.

WELDING EQUIPMENT—Smith Welding Equipment Corp., Minneapolis, has issued its new 1927 junior catalog describing various types of welding and cutting equipment that the firm manufactures. The catalog is of pocket size, well illustrated and contains a price list of the apparatus listed.

MOTORS—Heavy duty, direct current motors manufactured by the Reliance Electric & Engineering Co., Cleveland, are described in a new bulletin recently issued. This bulletin replaces a previous one of the same number.

SYNCHRONOUS MOTORS — The General Electric Co., Schenectady, N. Y., has issued a pamphlet describing its medium speed, 2 and 3-phase synchronous motors. These motors are from 100 to 700 horsepower and operate on 220, 440, 550 and 2200 volts.

FIRE EXTINQUISHER—Fyr-Fyter Co., Dayton, O., has issued a bulletin suggesting uses for its carbon tetrachloride-type portable extinguisher. Its use where water is not desirable is a feature.